44 142746
Dated 3/31/31
in RI/FS
bibliography

SPECIFICATIONS

FOR

DREDGING AND WATER TREATMENT

FOR

REMOVAL OF PCB CONTAMINATION

IN

WAUKEGAN HARBOR

WAUKEGAN, ILLINOIS

SPECIFICATIONS
FOR
DREDGING AND WATER TREATMENT

SPECIFICATION AND DRAWING INDEX

SPECIFICATIONS

DIVISION	SECTION	TITLE	PAGES
DIVISION 0 - BIDDING AND CONTRACT DOCUMENTS			
	00800	Supplementary Conditions	1 - 5
DIVISION 1 - GENERAL REQUIREMENTS			
	01010	Summary of Work	1 - 3
	01030	Special Project Procedures	1 - 8
	01150	Measurement and Payment	1 - 2
	01300	Submittals and Substitutions	1 - 4
	01400	Testing Laboratory Services	1 - 24
	01600	Temporary Facilities and Controls	1 - 3
	01850	Maintenance and Operations	1 - 14
DIVISION 2 - SITEWORK			
	02010	Harbor Borings	1 - 37
	02380	Cofferdam	1 - 6
	02396	Silt Curtains	1 - 3
	02494	Clay Liner Surface Treatment	1
	02881	Dredging	1 - 7
	02890	Docks and Facilities	1 - 2
DIVISION 3 - CONCRETE			
	03100	Concrete Formwork	1 - 2
	03200	Concrete Reinforcement	1
	03300	Cast-In-Place Concrete	1 - 5
DIVISION 4 - MASONRY		Not Used	
DIVISION 5 - METALS			
	05100	Structural and Miscellaneous Metals	1 - 4
DIVISION 6 THRU 9		Not Used	

DIVISION	SECTION	TITLE	PAGES
DIVISION 10		Not Used	
DIVISION 11 - EQUIPMENT			
	11237	Packaged Water Treatment System	1 - 11
DIVISION 12 THRU 14		Not Used	
DIVISION 15 - MECHANICAL			
	15010	General Provisions, Mechanical Work	1 - 5
	15050	Basic Materials and Methods	1 - 6
	15300	Special Piping Systems and Equipment	1 - 6
	15900	Instrumentation & Controls	1 - 6
DIVISION 16 - ELECTRICAL			
	16010	General Provisions, Electrical Work	1 - 8
	16050	Basic Materials and Methods	1 - 11
	16155	Motor Controls	1 - 7
	16160	Distribution Equipment (600 Volts & Below)	1 - 6
	16500	Lighting Systems	1 - 4
	16999	Electrical Field Acceptance Tests	1 - 3

DRAWING INDEX

GENERAL TITLE

U. S. Environmental Protection Agency
Region V
Chicago, Illinois

Waukegan Harbor Waukegan, Illinois

SHEET NO.	SPECIFIC TITLE
	GENERAL
G-1	Cover Sheet & Index
	CIVIL
C-1	Top of Muck Layer Waukegan Harbor
C-2	Bottom of Muck (Top of Sand) Layer Waukegan Harbor
C-3	Whole Harbor Plan
C-4	Slip No. 3 Plan
C-5	Cofferdam
C-6	Silt Curtain
C-7	Water Intake Structure

SHEET NO.	SPECIFIC TITLE
	MECHANICAL
M-1	Plan - Process and Dredge Piping
M-2	Plan - Dredge Piping
M-3	Lagoon, Underdrain & Leachate Sump Pumps - 1500 GPM System Plans & Sections
M-4	Sedimentation Basin & Clearwell Pumps - 1500 GPM System Plans & Elevations
M-5	Pump Schedule & Details
M-6	Lagoon, Sedimentation Basin & Clearwell Sump Pumps - 200 GPM System Plans & Elevations
M-7	Water Treatment Piping Plan & Elevation
M-8	1500 GPM Leachate & Rainwater Water Treatment System PCB Removal Waukegan Harbor
M-9	200 GPM Leachate & Rainwater Water Treatment System PCB Removal Waukegan Harbor
	ELECTRICAL
E-1	Site Plan - Electrical
E-2	Water Intake Structure - Plans & Details
E-3	Operations Building - Plans & Details
E-4	Sedimentation Basin, Clearwell & Underdrain & Leachate Sump Pumps - Plans and Details
E-5	Control Schematics
E-6	Schematics and Details

DIVISION 0 - BIDDING AND CONTRACT REQUIREMENTS

SECTION 00800
SUPPLEMENTARY
CONDITIONS

ARTICLE 1: LIMITS OF WORK:

The limits of the construction for this Work include: the waterway area of Waukegan Harbor (exclusive of the Waukegan Yacht Club dock area); adjacent shore areas defined by "Temporary Easement" lines shown on the Drawings; and the site of the existing lagoon and structures on the northeast side of the Upper Harbor.

ARTICLE 2: ACCESS TO THE SITE:

Normal access to the Work limits will be from Waukegan Harbor and from Seahorse Drive. Street access to the "Temporary Easement" at the west end of Slip Number 3 will be from Seahorse Drive. Seahorse Drive will also serve as the access to the lagoon site by way of the vehicle gate located on the north side of the site. All areas within the Limits of Work are accessible from Waukegan Harbor.

ARTICLE 3: TRAFFIC REGULATIONS AND CONTROL:

3.1 Construction vehicles and equipment shall not block public access to or along Seahorse Drive. During periods of heavy public traffic, e.g. shift changes or lunch periods, traffic shall not be delayed for a period exceeding 3 minutes.

3.2 The Contractor shall post warning signs each side of the entrances being used warning that construction equipment is entering and leaving the site. These signs shall be constructed, posted and bear the warning notice in accordance with the manual on Uniform Traffic Control Devices for Streets and Highways published by the American Association of State Highway Transportation Officials as applicable to the State of Illinois. The Contractor shall select the sign subject to the approval of the USEPA OSC.

3.3 The Contractor shall provide flagmen to control traffic in both directions each side of the entrances being used when heavy equipment and construction vehicles are entering and leaving the Limits of Work.

3.4 Truck Routes:

3.4.1 The Contractor shall consult with the Waukegan, Illinois, City Clerk for information regarding streets that have been designated as Truck Routes by the City of Waukegan and with the Illinois State Police for information regarding streets within Waukegan that have been designated Truck Routes by the State of Illinois.

3.4.2 During the design of this Work, information obtained from the sources in paragraph 3.4.1 indicated that Truck Routes controlled by Illinois limitations served the Sea Horse Drive area. Weight limitations imposed on these routes were: Single axle - 18,000 pounds; and Tandem axle - 16,000 pounds per axle.

3.4.3 The Contractor shall verify this information and obtain the required permits for use of these routes.

ARTICLE 4: TOXIC WASTE:

Trucks using Seahorse Drive between the west end of Slip No. 3 and the lagoon site access gate will be transporting polychlorinated biphenyl contaminated materials removed from Waukegan Harbor. The Contractor shall obtain the required permits to transport the contaminated materials and shall comply with the applicable regulations pertaining to transporting toxic substances.

ARTICLE 5: PERMITS OBTAINED BY OWNER:

5.1 The Owner will obtain the following permits that are required for this Work:

5.1.1 Chapter 3, Illinois Pollution Control Board Water Pollution Control construction and operating permit;

5.1.2 Chapter 7, Illinois Pollution Control Board Solid Waste developmental and operating permit;

5.1.3 Corps of Engineers, Chapter 10 of Rivers and Harbors Act of 1899, Dredging permit;

5.1.4 Corps of Engineers, Section 404 of the Clean Water Act, Dredging and Fill permit.

ARTICLE 6: EXISTING UTILITIES:

6.1 The utilities known to exist within the Limits of Work are shown on the Drawings. Existing utility services to the docks in Slip No. 3 and in the Upper Harbor are not shown on the Drawings but are to be removed and replaced in accordance with Section 02890: DOCKS AND FACILITIES. The Owner will furnish the Contractor with as-built drawings showing the location of piping and sewers that were constructed in connection with the development of the site of the existing lagoon.

6.2 All utility locations shown are approximate and the Contractor should contact the utility company for accurate locations if excavation work is necessary. However, the Contractor shall exercise extreme care to prevent damage to any utility and if such damage should occur, the Contractor shall take all measures necessary to restore the utility to service.

ARTICLE 7: SUBMITTALS:

Prepare and submit all Shop Drawings, Samples, Catalog Data, Certifications, Reports and other items in accordance with the provisions of the GENERAL PROVISIONS and Section 01300: SUBMITTALS AND SUBSTITUTIONS of these Specifications.

ARTICLE 8: AS-BUILT DRAWINGS:

The Owner will furnish one (1) set of blue and white prints which will be on file in the field office. The Contractor shall record on these prints, from day to day as the work progresses, all changes and deviations from the Drawings with special emphasis on the exact final location of all underground utilities by offset distances to surface improvements such as building corners, etc. Entries and notations shall be neat and legible and permanent. These prints shall be delivered to the USEPA OSC.

ARTICLE 9: PROTECTION OF LAGOON CLAY LINER:

The Contractor shall take all measures necessary to prevent penetration or erosion of the clay lined surfaces of the lagoon. To assist the Contractor in maintaining and protecting the lagoon, the Owner will furnish the Contractor with Drawings and Specifications used in the construction of the lagoon. If damage occurs to the clay lined surface, the repairs shall be made in accordance with the information so furnished. Installation of the sheet metal splash plates require 4 inch long cleats to penetrate the clay liner surface. If during the performance of the Work the splash plates are moved, the clay liner surface shall be repaired.

ARTICLE 10: PROJECT SCHEDULE:

The following schedule has been used in the preparation of these Drawings and Specifications. Changes in the schedule may impact on the work sequences described.

Notice of Award	1 March 1982
Begin Installation of Pumps and Piping, and Procurement of Packaged Water Treatment Systems	1 August 1982
Begin Dredging of Slip No. 3 and cofferdam construction	1 October 1982
Begin Installation of 1500 GPM Packaged Water Treatment System	1 March 1983
Begin Dredging of Upper Harbor and Water Treatment	15 April 1983
Begin Replacement of 1500 GPM with 200 GPM Water Treatment System	1 June 1983
Storage and Maintenance	1 August 1983 to 31 July 1985

ARTICLE 11: DEFINITIONS:

The following terms are used throughout these Specifications and wherever used have the meaning indicated:

Agreement - The written agreement between the Owner or the Owner's authorized representative, and the Contractor covering the Work to be performed; other Contract Documents are attached to the Agreement.

Bidder - Any person, firm or corporation submitting a Proposal for the Work.

Change Order - A written order to the Contractor signed by the Owner, or the Owner's authorized representative, authorizing an addition, deletion or revision in the Work.

Contract Documents - The Agreement, Addenda, the Request for Proposals (Technical and Price), the Contractor's Proposal, the Bonds, the Notice of Award, the General Provisions, these Supplementary Conditions, these Specifications, the Drawings, and Modifications.

Contract Price - The total monies payable to the Contractor under the Contract Documents.

Contractor - The person, firm or corporation with whom the Owner has executed the Agreement.

Drawings - The drawings which show the character and scope of the Work to be performed and which have been prepared by the Engineer/Architect and are referred to in the Contract Documents.

Engineer/Architect - Mason & Hanger-Silas Mason Co., Inc.
1500 West Main Street
Lexington, KY 40505

Modification - A written amendment or written clarification of the Contract Documents signed by the Owner, or the Owner's authorized representative, and the Contractor.

Notice of Award - The written notice given by the Owner to the apparent successful Contractor stating that upon compliance with the conditions precedent to be fulfilled by him within the time specified, the Owner will execute and deliver the Agreement to him.

Owner - The United States Environmental Protection Agency
Region V
Chicago, Illinois 60605

Project - The entire construction to be performed and the operation and maintenance of systems as described in the Contract Documents.

Proposal - The written presentation of the technical qualifications of a potential Contractor to perform the Work and/or the written presentation of the estimate of cost of the Work and the associated fixed fee.

Shop Drawings - All drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the Contractor, a Subcontractor, manufacturer, supplier, or distributor and which illustrate the equipment, material, or some other portion of the Work.

Specifications - The portion of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards, and workmanship that apply to the Work.

USEPA OSC - The authorized representative of the Owner who is assigned to the Project site or any part thereof, and who will act in the Owner's behalf. The Owner's representative may include the Office of Superfund Remedial Response Coordinator (RRC) or a designated representative of the RRC.

Work - Any and all obligations, duties, and responsibilities necessary to the successful completion of the Project assigned or undertaken by the Contractor under the Contract Documents, including all labor, equipment, materials, and other incidentals, and the furnishing thereof.

ARTICLE 12: SITE SECURITY:

The lagoon site is enclosed by a chain link fence with access gates to Seahorse Drive and Waukegan Harbor. The Contractor shall lock all perimeter gates to prevent entry of unauthorized persons during those periods of time when Contractor personnel are not on-site. The Contractor shall maintain the fence in good repair and shall provide and install and maintain signs on the fence. The signs shall be on each gate, and along the fence in sufficient numbers to be seen from any approach to the site. Lettering on the signs shall be of a size readable from a distance of 25 feet and shall present the message: "DANGER - UNAUTHORIZED PERSONNEL KEEP OUT".

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01010
SUMMARY OF WORK

1. GENERAL:

1.1 It is intended that this Work will remove polychlorinated biphenyl (PCB) contaminated sediment from the floor of a portion of Waukegan Harbor and store the sediment in an existing lagoon until the sediment can be transported to a permanent storage site.

1.2 Existing facilities to be utilized during the performance of this Work are located adjacent to Waukegan Harbor as shown on the Drawings. These facilities include:

(1) a site with access to the Harbor and to Sea Horse Drive,

(2) seven monitor wells to be used for monitoring ground water during the performance of this Work,

(3) an above ground lagoon with a liquid capacity of approximately 150,000 cubic yards plus two feet of freeboard. The lagoon consists of earth fill dikes lined with clay blankets between which a leachate collection system has been installed. Atop the clay blanket which serves as the floor of the lagoon is an underdrain system to be used for removal of water from the floor of the lagoon. A concrete retaining wall forms a compartment in the northeast corner which is to be used for containment of sediment dredged from Slip No. 3. An intake tower, equipped with valves and slide gate, is provided for removal of surface water which is to be treated,

(4) the leachate collection system sump,

(5) the underdrain system sump,

(6) a sedimentation basin,

(7) a clearwell with pipe to the Harbor,

(8) equipment pads and sumps for use with the packaged water treatment equipment which is specified as a part of this Work, and

(9) an Operations building (without utility services).

1.3 The Work consists generally of controlled dredging of Slip No. 3 in Waukegan Harbor and of the upper portion of Waukegan Harbor to remove the contaminated sediments, placement of dredging spoils in the existing lagoon, treatment of the slurry water and its return to the Harbor, maintenance and operation of the lagoon and associated structures and equipment while contaminated materials are stored in the lagoon, and water treatment during the period in which the stored materials are being removed from the lagoon.

1.4 More specifically, the Work consists of the following:

1.4.1 Removal, salvage, and reconstruction work associated with docks and piling at the locations shown on the Drawings, and with utilities such as water, electricity, and fuel pumps which are connected to or located on the docks and piling.

1.4.2 Harbor dredging, including:

(1) controlled dredging of those portions of Waukegan Harbor which are designated on the Drawings as "Main Channel Area 1 (Upper Harbor)" and "Slip No. 3",

(2) conveying the contaminated sediment that is dredged from these areas to the existing lagoon by means of a dredge pipeline with watertight joints,

(3) placement of the dredged material in the lagoon using a procedure that will insure an even disposition of the material throughout the area of the lagoon,

(4) depth measurements for the purpose of determining quantity of sediment removed and the percentage of sediment removed,

(5) silt curtain installation and removal with provisions for an oil boom and pick-up equipment,

(6) performance of sampling and testing required as part of the dredging monitoring program specified, and

(7) furnishing all labor, materials, and equipment (to include dredge piping) to perform the dredging as specified.

1.4.3 Removal of contaminated sand and clay from the floor of Slip No. 3, including:

(1) design and construction of a cofferdam,

(2) dewatering of the cofferdam and pumping all water thru a watertight dredge pipeline to the lagoon,

(3) transportation of the sand and clay to the lagoon in trucks with watertight beds,

(4) testing excavated area to insure removal of PCB contamination,

(5) refill of excavated area of Harbor floor,

(6) removal and closure of a discharge pipe, and

(7) removal and reconstruction of a water intake.

1.4.4 Treatment of water used to convey sediment to the lagoon and return of the treated water to the Harbor, including:

(1) construction of the process piping systems shown on the Drawings (Existing facilities contain provisions for mounting pumps associated with the process piping),

(2) construction of the polymer feed system, the electrical control system, the site lighting system, and the heating and lighting in the Operations Building,

(3) construction of utility (electric, water, and telephone) services to the site,

(4) design, construction, and installation of the 1,500 GPM packaged water treatment system and interface with the process piping system,

(5) operation of all water treatment systems by operators certified by the Illinois EPA,

(6) testing to insure quality of all effluent prior to return of treated water to the Harbor,

(7) replacement of the 1,500 GPM water treatment system with a 200 GPM water treatment system with some reuse of portions of the 1,500 GPM system equipment possible, and

(8) construction of a building to house the 200 GPM packaged water treatment equipment.

1.4.5 Maintenance of the lagoon containing contaminated material, including:

(1) control of volatilization by use of a shallow depth of water covering the sediment and by surface treating the clay liner side slopes above the water level, and

(2) sampling monitor wells and testing of samples.

1.4.6 Routine maintenance and repair of all systems and routine site work throughout the term of the Work.

1.4.7 Treatment of water during the removal of contaminated sediments from the lagoon.

1.4.8 Removal of the 200 GPM water treatment system upon completion of sediment removal.

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01030
SPECIAL PROJECT
PROCEDURES

1. GENERAL:

1.1 This Section specifies the special procedures required for handling polychlorinated biphenyl (PCB) contaminated materials and describes special job conditions that may be encountered. These special procedures and conditions are refered to throughout these Specifications.

1.2 Job (working place) safety conditions are governed by local, state, and federal regulations; thus, the special procedures described herein are in no way intended to conflict with those regulations as they apply to this Work.

1.3 Protection of Personnel Handling PCB Contaminated Material:

1.3.1 Protective Clothing:

1.3.1.1 General Requirements: All persons who may come in contact with heavily-contaminated sediments shall wear the protective clothing described in Paragraph 1.3.1.2 of this Section. Heavily-contaminated sediments include sediments from Slip #3 and sediments from the Upper Harbor (i.e. sediments over 50 ppm of PCB). In addition, protective clothing shall be worn by anyone entering any of the sumps, the sedimentation basin, the lagoon intake tower or the lagoon proper even if sediment PCB concentrations are less than 50 ppm. Protective clothing need not be worn for protection from harbor water or from occasional contact with slightly contaminated sediments.

1.3.1.2 Description of Protective Clothing: Protective clothing shall consist of (1) a one-piece coverall to be worn over street clothing which meets OSHA requirements for use when dealing with toxic substances (e.g. Fisher catalogue 01-377-10 or equal), (2) disposable shoe covers or boots, and (3) disposable vinyl gloves. There are additional requirements for personnel entering the cofferdam in Slip #3 and the lagoon intake tower.

1.3.1.3 Activities Requiring the Use of Protective Clothing: Protective clothing shall be worn by people engaging in the following activities:

(1) Installation and removal of silt curtains;

(2) Removal of sheet piling and dock piling and docks;

(3) Dredging of Slip #3 and Dredging of the Upper Harbor;

(4) Cleanup of PCB-contaminated equipment, sumps, basins, silt curtains, piling, or spills;

(5) Entering the sedimentation basin, the lagoon intake tower, or the lagoon proper when PCB-contaminated sediment may be present.

(6) Removal of filter media or spent carbon from the water treatment system or repair of lagoon, sedimentation basin and sump pumps.

(7) Removal of sand and clay from within the cofferdam.

(8) Any other activity which may result in people contacting heavily-contaminated sediment or where USEPA-OSC may require.

1.3.1.4 Protective clothing normally need not be worn by personnel collecting water samples or who are simply on site.

1.3.1.5 Disposal of Used Protective Clothing: Persons wearing protective clothing shall remove this clothing when leaving the project limits, except during transport of contaminated sand and clay from the cofferdam to the lagoon. All contaminated protective clothing shall be placed in properly identified drums with sealable lids. The Contractor shall store the drums on-site until the removal of the sediment from the lagoon is in progress. At that time the drums will be disposed of along with the sediments. However, the USEPA OSC may arrange for proper disposal of the drums prior to the removal of sediments from the lagoon.

1.3.2 Safety Shower:

1.3.2.1 The Contractor shall provide a safety shower which is to be located within the curbed area of one of the equipment pads. Potable water shall be used for the shower and the equipment pad sump will collect and return the shower waste water to the lagoon or sedimentation basin.

1.3.2.2 Following installation of the 200 GPM water treatment system, this shower shall be located within the building provided with the 200 GPM system.

1.3.2.3 This shower shall be used by an individual that has been exposed to heavily contaminated material due to not wearing protective clothing or due to a puncture in the protective clothing being worn.

1.3.3 Visitors:

1.3.3.1 The Contractor shall take precautions to prevent unauthorized access to the lagoon and water treatment site, or to dredging operations and lines. The Contractor shall maintain a visitor log for authorized persons.

1.3.3.2 The USEPA OSC will decide on a policy for visitors who wish to visit the facilities. All visitors shall be cleared through USEPA OSC.

1.3.3.3 The Contractor shall provide protective clothing for authorized visitors if they can come in contact with contaminated sediments during their visit.

1.4 Cleaning PCB Contaminated Equipment:

1.4.1 General Requirements: All equipment or material which has been in contact with PCB contaminated sediments or Harbor water during any phase of the Work must be washed or flushed with water before the Contractor removes it from the site. The wash water shall be transferred to the lagoon or seimentation basin for processing unless otherwise stated. City (potable) water or treated water from the clear well shall be used for the final washing or flusing step for contaminated items unless otherwise stated. The Contractor is to supply any tanks, tubes, hoses, plastic sheeting, etc. used for cleaning and to clean and remove them after they have served their purpose. Plastic sheeting and contaminated small materials should be containerized in a sealable drum for storage on-site.

1.4.2 Dredge Piping and Equipment: The Contractor shall flush out the dredge lines with Harbor water for at least one hour following completion of dredging. This water shall be transferred to the lagoon. The exterior of the dredging equipment shall be washed with water before the dredging equipment is removed from the project limits. Where practical, the Contractor should collect this water and transfer it to the lagoon or sedimentation basin.

1.4.3 Silt Curtains and Oil Booms:

1.4.3.1 Silt curtains and oil booms removed from the Harbor shall be washed with Harbor water to remove any adhering sediment. The wash water may be returned to the Harbor. The Contractor shall remove and wash the silt curtains and oil booms in a manner that will prevent the adhering sediments from being deposited on the shore. Washing could be accomplished by using a barge to pick up the curtain and cleaning it from the barge or by preparing an area on shore that would be curbed with earth curbs and then covered with a liner such as heavy-weight polyethylene. Wash water from the area on shore would be returned to the Harbor. The Contractor must exercise extreme care to prevent puncturing the liner. After the silt curtain(s) is washed, the liner shall be flushed with Harbor water and removed to storage. The liner shall be stored in a properly identified sealable drum and labeled either for re-use in this Work or for disposal.

1.4.3.2 When the silt curtains and oil booms are no longer required for the Work, the Contractor shall store them on-site for disposal. However, the Contractor may retain the silt curtain fabric and weights for future use elsewhere. The material used for flotation of the silt curtain

shall be removed from the silt curtain and stored on-site for disposal. All material stored on-site for disposal shall be placed in sealed metal containers and properly identified for disposal.

1.4.4 Piling:

1.4.4.1 Any piling for docks and sheet piling bordering Slip No. 3 which is removed to accomodate Slip No. 3 dredging and excavation shall be washed to remove attached sediments. The wash water shall be transferred to the lagoon or sedimentation basin. The piling shall be washed whether it is to be reused or removed from site.

1.4.4.2 Washing may be done in two ways. The piling may be placed directly in an open tank adjacent to the Harbor and washed in this tank using potable water. Alternatively, the piling may be individually wrapped in plastic sheeting and moved to the lagoon site for washing at the lagoon site. The piling should not be placed on shore unless either contained in a tank or wrapped with plastic sheeting. The Contractor is reminded that PCBs from heavily-contaminated sediments can diffuse through polyethylene and other plastic films so storage in plastic sheeting should be temporary (less than a few days) before the pilings are washed.

1.4.5 Sedimentation Basin, Clear Well, Sumps, Packaged Water Treatment Systems, and Piping:

1.4.5.1 The schedules for cleaning the various sumps, sedimentation basin, and clear well are detailed in the appropriate Sections of the Specifications. In addition, the Contractor should clean out the sedimentation basin and sumps if sediment should accumulate such that it interferes with water treatment plant operation.

1.4.5.2 Cleaning shall consist of flushing with potable water to dislodge any sediment and transporting the cleanout water and sediment to the sedimentation basin for processing by the water treatment system.

1.4.5.3 After the removal of sediment from the lagoon (by others), the Contractor shall continue to operate the water treatment system to process cleanout water. As much cleanout water as practical shall be processed through the water treatment system in order to minimize the quantity of water to be disposed of by others.

1.4.5.4 The Contractor shall make arrangements for final disposal of filter media, spent carbon, and residual water and sediments from the sedimentation basin.

1.4.5.5 Excess sedimentation basin water may also be discharged directly to the Harbor with USEPA OSC concurrence if the water contains less than 1 part per billion. The Contractor is responsible for the necessary tests to demonstrate that this water contains less than 1 part per billion PCB.

1.4.6 Cleaning Trucks:

1.4.6.1 Trucks used to transport the contaminated sand and clay from the cofferdam area to the lagoon shall be cleaned after they are loaded and prior to leaving the loading pad adjacent to the cofferdam. Contaminated material that has adhered to the outside of the truck or to the tires shall be removed by use of hand tools and the truck then washed-down with Harbor water. The wash water will be diverted to within the cofferdam where sump pumps will transport it to the lagoon. CAUTION: TRUCKS SHALL NOT BE CLEANED WHEN PERSONNEL ARE WITHIN THE COFFERDAM! After unloading the contaminated sand and clay at the lagoon, the trucks shall be washed-down with potable water and the wash water diverted to the lagoon. Care shall be taken to prevent erosion of the clay lined surface of the lagoon.

1.4.6.2 Wash water from trucks will be generated during the removal of sediments from the lagoon by others. A portion of or all of the wash water may require treatment by the water treatment system as directed by the USEPA OSC.

1.4.7 Spillage:

1.4.7.1 The Contractor is responsible for cleaning any of the concrete pads and grounds if spillage has occurred as the result of his activities. The concrete pad wash water should be flushed into the sumps. Spillage which occurs elsewhere should be placed in drums or tanks and transported to the lagoon. Solids may be left in properly labled, sealed drums for later disposal.

1.4.7.2 The Contractor is responsible for treating any water associated with spillage or its cleanup whether caused by his activities or by activities of others. Excluded from this requirement is the residual water in the sedimentation basin at the time of removal of the water treatment system.

1.4.7.3 The Contractor shall document all incidences of spillage and associated cleanup action and upon completion of the cleanup action he/she shall submit four copies of the information to the USEPA OSC. The incident to be reported shall have occured as the result of the Contractors activities and the report shall include: the date; the time; the location of the spill; whether liquid or solid material was involved; level of contamination if known; names of personnel involved; area affected by the spill; and a description of the clean up action taken. If tests are required during the cleanup action, then the results of those tests are to be submitted with the report.

1.4.8 Analytical Equipment:

1.4.8.1 Any equipment used to sample water, sediment, or soils for PCB analysis shall be washed with water and rinsed with acetone to remove any residual contamination. The composite sampler and turbidity

analyzers need not be daily washed with acetone if the water shows 1 ppb of PCB or less. However, if more than 1 ppb of PCB is detected in the clear well water, the Contractor shall flush out the composite sampler lines with clean water and acetone to remove residual contamination.

1.4.8.2 Spent wash water shall be placed in the sedimentation basin or in the lagoon. The Contractor shall provide a red cannister that can be tightly sealed. The Contractor shall place contaminated acetone in the red cannister which when full shall be disposed of properly. Contaminated rags and other contaminated materials shall be placed in a properly identified sealed drum and stored on-site for disposal.

1.5 Removal of Contaminated Material From the Cofferdam:

1.5.1 Dewatering Cofferdam: The cofferdam shall be dewatered with all water from within the working area to be pumped to the lagoon. The Contractor shall maintain the excavation in a dry condition by pumping all water entering the excavation to the lagoon.

1.5.2 Disposal of Contaminated Material:

1.5.2.1 The Contractor shall transport all sediment, sand, and clay that is excavated from within the cofferdam to the lagoon. These materials shall be placed within the area of the northeast compartment of the lagoon. Where practical, the Contractor should place the more contaminated material into the lagoon first and cover that material with the lesser contaminated materials. The Contractor shall maintain at least a one foot depth of water over these materials.

1.5.2.2 All other materials such as concrete, steel, and the intake and discharge piping shall be washed with Harbor water to remove attached sediments (See Paragraph 1.4.1 of this Section). If the material is to be disposed of, it shall be transported to the lagoon site and stored on site at the toe of the north slope of the lagoon. If the material is to be reused, it shall be wrapped with plastic sheeting and stored adjacent to the cofferdam.

1.5.2.3 Materials to be washed shall be placed on the truck loading pad adjacent to the cofferdam. The wash water will be diverted to within the cofferdam where sump pumps will transport it to the lagoon. CAUTION: MATERIAL SHALL NOT BE WASHED WHEN PERSONNEL ARE WITHIN THE COFFERDAM!

1.5.2.4 Plastic sheeting used shall be disposed of by placing in a properly identified sealed drum and stored on-site for disposal.

1.5.2.5 Following completion of the portion of the Work that requires the use of the bituminous loading pad adjacent to the cofferdam, the loading pad shall be flushed with Harbor water and the water pumped to the lagoon. The loading pad shall be demolished and the bituminous material shall be transported to the lagoon site and stored at the toe of the north slope of the lagoon.

1.5.3 Testing for PCB Contamination in Clay:

1.5.3.1 After the Contractor has removed clay material from the cofferdam to depths indicated on the Drawings, clay samples shall be taken to determine the extent of additional contamination. The location and number of samples will be as directed by the USEPA OSC.

1.5.3.2 Cores at least 1.5 inches in diameter shall be advanced two feet into the clay at the locations designated by the USEPA OSC. Samples 6 inches long shall be taken from the cores beginning at 6 to 12 inches from the top and then at 18 to 24 inches. The sampling device shall be cleaned with water between each sample to dislodge any material followed by wiping with acetone. The samples shall be placed in a 32 oz. glass jar filled with a teflon or aluminum inserts or lids. The location and depth of the sample shall be noted on each jar.

1.5.3.3 The samples shall be sent to the Testing Laboratory for analysis of PCB and percent moisture as described in Section 01400: TESTING LABORATORY SERVICES. Results reported by the Testing Laboratory shall include the location and depth of the sample tested.

1.5.4 Protection of Personnel Within the Cofferdam:

1.5.4.1 In addition to wearing the protective clothing described in Paragraph 1.3.1 of this Section, persons entering the dewatered cofferdam shall wear: (1) a hardhat; (2) hip waders; (3) a safety harness with chest webbing; and (4) a respiratory protective device.

1.5.4.2 The hardhat and the respiratory protective device shall conform to the requirements of the Occupational Safety and Health Administration (OSHA) Safety and Health Standards. The USEPA OSC will furnish the Contractor with data from the Air Monitoring Program which is being performed by others. The Contractor shall use the data for guidance in selecting the proper respiratory protective device for work within the cofferdam.

1.5.4.3 The safety harness with chest webbing shall be equipped such that an unconscious or injured worker can be pulled out of the cofferdam by attaching ropes and pulleys which the Contractor shall provide. This equipment is to allow workers to descend into and work in the cofferdam without remaining attached to ropes and at the same time provide for fast removal of the worker if necessary.

1.5.4.4 The Contractor shall limit the exposure time of a worker within the cofferdam to a period governed by the results of the Air Monitoring Program (performed by others) but in no case shall the period exceed two hours per day per person.

1.5.4.5 When personnel are required within the cofferdam, at least two people shall enter the cofferdam and at least one person shall be stationed at the top of the cofferdam to observe the persons within the cofferdam.

1.6 Divers shall not be used during the performance of the Work unless the Contractor submits information in writing to the USEPA OSC showing that divers are required and that the diver(s) will be protected from contact with the contaminated sediments or materials. If the USEPA OSC concurs, then written approval to use divers shall be given to the Contractor. NOTE: SAMPLES TAKEN OF WAUKEGAN HARBOR SEDIMENT INDICATES THAT THE SEDIMENT WILL NOT SUPPORT THE WEIGHT OF A PERSON! See Section 02010: HARBOR BORINGS.

1.7 The Contractor should note that seiches have occured in Waukegan Harbor and persons now working in or near the Harbor have reported that a water level change of at least two feet was observed during a seiche.

1.8 Control of volatilization of PCB is described in various Sections of these Specifications. As a result of data obtained from the Air Monitoring Program, which is to be performed by others, the USEPA OSC may require additional controls. The USEPA OSC will furnish the Contractor with a written description of any additional controls necessary.

SECTION 01150
MEASUREMENT
AND PAYMENT

1. GENERAL:

1.1 The Estimate of Cost of this Work and the Fixed Fee for performance of this Work shall be prepared in accordance with the GENERAL PROVISIONS and SUPPLEMENTARY CONDITIONS as supplemented by this Section.

1.2 Dredging:

1.2.1 Quantities shown for volumes of muck or muck and sand mixture are approximate. These quantities are to be used in preparation of the estimate of cost of the Dredging work. Also included in the Dredging cost estimate shall be the cost of the dredge pipe line from the Harbor to the lagoon site; the cost of dredge line piping on the lagoon site; and the cost of flexible hose and float system (or other system proposed by the Contractor) for depositing dredged material in the lagoon.

1.2.2 The volume of dredged material shall be as determined by measurements taken in accordance with Section 02881: DREDGING.

1.2.3 The Dredging portion of the fixed fee shall be based on the estimated cost and will be subject to an increase when the measured volume of dredged material exceeds the estimated volume by fifteen percent (15%).

1.3 Cofferdam:

1.3.1 The limits of excavation of sand and clay shown on the Drawings are to be used in preparation of the estimated cost of the Cofferdam. The Cofferdam estimated cost shall also include the cost of construction and removal of the complete Cofferdam; the cost of closing the outlet pipe; the cost of removal and reconstruction of the intake pipe and intake structure; the cost of all dewatering of the cofferdam and of pumping the water to the lagoon via a pipeline with watertight joints; the cost for replacement of the steel sheet piling removed from the existing bulkhead to allow construction of the Cofferdam; and the cost of removing and transporting the sand and clay to the lagoon site and placing the material in the lagoon.

1.3.2 Additional excavation may be required to remove contaminated clay. The volume of the sand and clay removed shall be the measured volume of the excavation within the Cofferdam.

1.3.3 The Cofferdam portion of the fixed fee shall be based on the estimated cost and shall be subject to an increase only when the volume of the excavation exceeds the estimated volume by one hundred percent (100%).

1.4 Water Treatment - 1500 GPM System:

1.4.1 The quantity of water to be treated with the 1500 GPM Water Treatment System is to be estimated and the estimate used in preparation of the estimated cost of the System. The estimated cost of the System shall also include: the cost of providing, installing, operating, and maintaining the complete System;and the cost of removing the System, exclusive of the polymer feed system, and piping and pumps that will be reused as part of the 200 GPM System.

1.4.2 The quantity of water treated shall be as measured by a meter installed at the inlet of the clearwell.

1.4.3 The portion of the fixed fee attributed to this Water Treatment System shall be based on the estimated cost and shall not be increased unless the total volume of the dredged material exceeds the estimated volume by fifteen percent (15%) and the total quantity of water measured as described above exceeds the estimated quantity by fifteen percent (15%).

1.5 Water Treatment - 200 GPM System:

1.5.1 The quantity of water to be treated with this system will be produced by the net amount of annual precipitation and evaporation, and the water released from the dredged material as settlement within the mass occurs. For the purpose of estimating the cost of this portion of the Work, this treatment system will be required for a period beginning with the removal of the 1500 GPM Water Treatment System and terminating July 31, 1985. The estimated cost shall include the cost of periodic water treatment; the cost of providing, installing, operating, and maintaining the complete system; and the cost of removal of the complete system.

1.5.2 The portion of the fixed fee attributed to this Water Treatment System shall be based on the estimated cost.

1.6 Testing Laboratory Services:

1.6.1 Testing Laboratory Services are to be required as set out in the Specifications and the estimate of cost shall include furnishing these services until July 31, 1985.

1.6.2 The portion of the fixed fee attributed to these services shall be based on the estimated cost.

1.7 Other Work:

1.7.1 An estimate of cost shall be prepared for all items of the Work not specifically set out above and shall contain the cost of services, utilities, and supplies that are to be provided over the time period commencing with the Notice to Proceed date and terminating July 31, 1985.

1.7.2 The portion of the fixed fee attributed to these items shall be based on the estimated cost.

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01300
SUBMITTALS AND
SUBSTITUTIONS

1. GENERAL:

1.1 Description:

1.1.1 Work Included:

1.1.1.1 Wherever possible throughout the Contract Documents, the minimum acceptable quality of workmanship and materials has been defined either by manufacturer's name and catalog number or by reference to recognized industry standards.

1.1.1.2 To ensure that the specified products are furnished and installed in accordance with design intent, procedures have been established for advance submittal of design data and for its review and approval or rejection by the USEPA OSC.

1.1.2 Related Work Described Elsewhere:

1.	Contractural requirement for submittals:	General Provisions and Supplementary Conditions
2.	Individual submittals required:	Pertinent Sections of these Specifications

1.2 Product Handling: Make all submittals of Shop Drawings, Samples, Test Reports, Catalog Data, Certification, requests for substitutions, and other items, in strict accordance with the provisions of this Section of these Specifications.

2. SUBMITTALS:

2.1 Shop Drawings:

2.1.1 Scale Required: Unless otherwise specifically directed by the USEPA OSC, make all Shop Drawings accurately to a scale sufficiently large to show all pertinent features of the item and its method of connection to the Work.

2.1.2 Type of Prints Required: Unless otherwise specifically directed by the USEPA OSC, make all Shop Drawing prints in blue or black line on white background.

2.1.3 Number of Prints Required: Submit all Shop Drawings in the quantity which is required to be returned plus two copies which will be retained by the USEPA OSC.

2.2 Samples:

2.2.1 Accuracy of Sample: Unless otherwise specifically directed by the USEPA OSC, all samples shall be of the precise article proposed to be furnished.

2.2.2 Number of Samples Required: Submit all Samples in the quantity which is required to be returned plus two which will be retained by the USEPA OSC.

2.3 Catalog Data:

2.3.1 Information Required: Catalog Data shall contain both descriptive information and technical information which pertains to the specific product proposed for use in the Work.

2.3.2 Quantity Required: Submit all catalog data in the quantity which is required to be returned plus two copies which will be retained by the USEPA OSC.

2.4 Certifications: Four copies of all certifications required by these Specifications shall be submitted to the USEPA OSC, unless otherwise stated in the pertinent Section.

2.5 Test Results:

2.5.1 General: Reports of results of tests are required in various Sections of these Specifications.

2.5.2 Number of Copies Required: The number of copies of reports of test results are specified in the various Sections. If a test report is required by these Specifications and the number of copies is not defined for that report, then four copies shall be submitted to the USEPA OSC.

2.6 Contractor and Testing Laboratory Qualifications:

2.6.1 Submittal of qualifications is required in various Sections of these Specifications.

2.6.2 All qualifications shall be submitted with the Proposal.

2.7 Design Calculations:

2.7.1 General: Design calculations are required in various Sections.

2.7.2 Number of Copies Required: Two copies of all design calculations, sketches, and reference material shall be submitted to the USEPA OSC.

2.8 Substitutions:

2.8.1 USEPA OSC Approval Required:

2.8.1.1 The Agreement is based on the materials, equipment, and methods described in the Contract Documents.

2.8.1.2 The USEPA OSC will consider proposals for substitution of materials, equipment, and methods only when such proposals are accompanied by full and complete technical data and all other information required by the USEPA OSC to evaluate the proposed substitution.

2.8.1.3 Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this Work by the USEPA OSC.

2.8.2 "Or Approved Equal":

2.8.2.1 Where the phrase "or approved equal" occurs in the Contract Documents, do not assume that material, equipment, or methods will be approved as equal by the USEPA OSC unless the item has been specifically approved for this Work.

2.8.2.2 The decision of the USEPA OSC shall be final.

3. EXECUTION:

3.1 Identification of Submittals: Completely identify each submittal or resubmittal by showing at least the following information:

(1) Name and address of Contractor, plus name and telephone number of the individual who may be contacted for further information.

(2) Name of project as it appears in these Specifications.

(3) Drawing Sheet number and Specifications Section number to which the submittal applies.

(4) Whether this is an original submittal or resubmittal.

3.2 Coordination of Submittals:

3.2.1 Submittals Other Than Test Results: Prior to submittal for review by the USEPA OSC, use all means necessary to fully coordinate all material, including the following procedures:

(1) Determine and verify all field dimensions and conditions, materials, catalog numbers, and similar data.

(2) Coordinate as required with all trades and with all public agencies involved.

(3) Clearly indicate all deviations from the Contract Documents and furnish the necessary information needed to comply with Paragraph 2.8 above.

(4) Unless otherwise specifically permitted by the USEPA OSC, make all submittals in groups containing all associated items; the USEPA OSC may reject partial submittals as not complying with the provisions of the Contract Documents.

3.2.2 Submittal of Test Results: Test results shall be submitted upon completion of the test. Group submittals are not required.

3.3 Timing of Submittals:

3.3.1 Submittals Other Than Test Results:

3.3.1.1 Make all submittals far enough in advance of schedule dates of installation to provide all required time for reviews, for securing necessary approvals, for possible revision and resubmittal, and for placing orders and securing delivery.

3.3.1.2 In scheduling, allow at least ten full working days for review by the USEPA OSC following his/her receipt of the submittal.

3.3.2 Submittal of Test Results: Timing requirements for the submittal of Test Results are specified in the various Sections. Where not specified, submit Test Results seven days in advance of scheduled delivery of material or installation of material.

3.3.3 Delays: Costs of delays occasioned by tardiness of submittals may be back-charged as necessary and shall not be borne by the Owner.

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01400
TESTING LABORATORY
SERVICES

1. GENERAL:

1.1 Purpose: During the progress of the Work, certain testing, both laboratory and field, is to be performed to insure that PCB-contaminated material is removed as described in these Specifications without unnecessarily spreading pollutants to the environment. There is a possibility that heavy metals and other pollutants may exist in the Waukegan Harbor sediments and in the ground water of the lagoon site. Thus, analysis work includes some testing for contaminants other than PCB. The required testing includes analysis of water, sediment and soil samples. Soil Testing Services consisting of compaction and maximum density tests, and Concrete Testing services are also required. Air quality monitoring (for volatile PCBs) will be done by others.

1.2 Approved Testing Laboratory:

1.2.1 The Contractor shall retain the services of the Testing Laboratory(s) and shall submit the name of the proposed Laboratory(s) to the USEPA OSC for approval. All PCB analyses shall be performed by one Laboratory; however, the Contractor may elect to use a different Laboratory for sample collection and for analysis of other constituents, or for physical tests of soil.

1.2.2 The Testing Laboratory(s) must satisfy the following requirements:

(1) The name of the Testing Laboratory(s) along with the experience and background of the Laboratory, the individuals involved, and a Quality Assurance Program shall be submitted with the Proposal.

(2) The Testing Laboratory(s) shall have the necessary equipment, be familiar with analysis for PCBs and other constituents specified, and/or be experienced in performing the physical testing of soils and concrete.

(3) Testing for PCBs in soil samples shall be conducted in accordance with "Chemistry Laboratory Manual for Bottom Sediments and Elutriate Testing", USEPA Chicago, Illinois, March 1979, unless otherwise specified in these Specifications.

(4) Testing for PCBs in water shall be conducted in accordance with "Sampling and Analysis Procedures for Screening Industrial Effluents and Priority Pollutants" Method 608, USEPA Effluent Guidelines Division, March 1977. Later revised editions of this document are acceptable such as the revision listed in Federal Register of 3 December 1979.

(5) Testing for other water constituents shall be conducted in accordance with the "Manual of Methods of Chemical Analysis of Water and Wastes", USEPA, March 1979. This manual is available from the USEPA, Cincinnati, Ohio 45268.

(6) Material testing in the field and in the laboratory shall be performed by qualified soil testing personnel under the supervision of either a Registered Professional Engineer or a Registered Geologist and all reports submitted to the USEPA OSC shall bear the seal of the Engineer or Geologist.

(7) The Testing Laboratory(s) must allow representatives of the USEPA OSC to inspect equipment, procedures, and observe analyses if and when requested by the USEPA.

(8) The Testing Laboratory(s) must complete the Quality Assurance program requirements associated with PCB sampling and analysis. See paragraph 3.5 of this Section.

(9) The USEPA OSC may direct that the Contractor provide an alternate Testing Laboratory(s) if in the judgement of the USEPA OSC the initially approved Testing Laboratory(s) fails to meet the above requirements or if it cannot meet the time frame defined in Paragraph 1.4 of this Section.

1.3 Testing Laboratory Responsibilities:

1.3.1 Analyses: All water samples and all soil samples shall be analyzed by the approved Testing Laboratory(s). The only exceptions are that the Contractor shall measure pH and turbidity of any water samples that he collects himself, and may perform other measurements of a trouble shooting nature which are in addition to the scheduled analyses.

1.3.2 Samples:

1.3.2.1 The Testing Laboratory(s) shall collect the following samples:

(1) Samples from all monitoring wells and leachate sump.

(2) All water samples collected from Waukegan Harbor.

(3) All water samples collected from the City water filtration plant located near the mouth of Waukegan Harbor.

(4) All sediment samples collected from the bottom of Waukegan Harbor.

1.3.2.2 The Contractor may collect the following samples himself or assign this responsibility to the Testing Laboratory:

(1) Water discharged to the Harbor from the water treatment process.

(2) Water samples taken within the water treatment process or lagoon.

(3) Water samples of a trouble shooting nature in addition to regularly scheduled samples (for example as described in SECTION 01850 paragraph 3.15).

(4) Any shore soil samples.

(5) Sediment and soil samples collected within the Cofferdam in Slip No. 3.

1.3.3 Soil Testing: The Testing Laboratory(s) shall perform all soil compaction and maximum density tests, and all concrete testing.

1.3.4 Equipment: All sampling and testing equipment, including sample bottles shall be provided by the Testing Laboratory(s).

1.4 Time Frame for Reporting Water and Sediment (Soil) Analyses:

1.4.1 The Testing Laboratory shall report to the Contractor and USEPA OSC the results of any Turbidity measurements of Waukegan Harbor water samples within 4 hours after the sample is collected. The Contractor shall report the results of any pH and turbidity measurements, made by the Contractor, to the USEPA OSC immediately following the measurement.

1.4.2 The Testing Laboratory shall report to the Contractor the results of PCB analyses of water discharged to Waukegan Harbor within 24 hours of the time the samples are collected. This 24 hour period includes delivery time of the collected water samples to the Testing Laboratory prior to the analysis, analysis time, and reporting time. The Contractor shall immediately report to the USEPA OSC any instance when water discharged to Waukegan Harbor exceeds 1.0 part per billion (ppb) (1.0 ug/liter) of PCB and take appropriate action.

1.4.3 All treated water discharged to Waukegan Harbor shall contain not more than 1 ppb of PCB. The Contractor is responsible for recording the results of PCB analyses reported to him by the Testing Laboratory in addition to recording pH and turbidity. The PCB analyses of treated water discharged shall be plotted on a daily basis so that projected increases to 1 ppb may be predicted and appropriate action taken.

1.4.4 The Contractor shall direct that the Testing Laboratory complete an "as is" PCB analysis of sediment and soil samples collected within the Cofferdam in Slip #3 and submit 4 copies of a report on the results within not more than 24 hours to the USEPA OSC. The Testing Laboratory shall also complete a percent solids content analysis on a second portion of each of the samples and submit 4 copies of a report on the results to USEPA OSC. The percent solids content analysis will require about one week to complete. The reports on PCB and percent solids shall bear a sample identifying number, date, location, depth, and verbal description (sand, gravel, clay, ooze, etc.) so they can be easily referenced.

1.4.5 The Testing Laboratory shall analyze and report the results of other tests to the Contractor without delay, and in no case more than two weeks after sample collection time (unless a time extension is agreed to by the USEPA OSC). The Contractor should note that dredging of Slip #3 may be suspended after 3 days of continuous dredging until water sample analysis collected during the dredging monitoring program has been completed and reported to USEPA OSC.

1.5 Reporting Results:

The Contractor shall promptly process all analytical results, whether performed by the Testing Laboratory or measured on site by the Contractor. These results shall be recorded and four copies, unless otherwise specified, shall be furnished to the USEPA OSC on a daily basis. Each analysis shall bear a sample identification number, type of sample (e.g.; water, muck, sand, clay, etc.), collection time and date, location, and type of analysis so it can be easily referenced.

1.6 Cooperation:

1.6.1 For Performance of Work Related Testing and Sampling: Representatives of the Testing Laboratory(s) shall have access to the Work at all times for the performance of testing required in the Specifications, for the performance of other testing authorized by the USEPA OSC, and for performance of any required retesting. The Contractor shall provide safety equipment where required. The Contractor may accompany the Testing Laboratory representative during collection of the samples and may provide assistance with the sampling.

1.6.2 For Performance of Air Monitoring by Others: Representatives of the team authorized by USEPA OSC to take air quality measurements shall also have access to the Work including the lagoon area, water treatment area, dredging operations, cofferdam, and Waukegan Harbor. The air quality measurement team shall provide their own sampling and safety equipment. Their activities are not part of these Specifications, except that the Contractor shall provide an observer for safety reasons if entry is made inside the cofferdam. The Contractor may temporarily deny access of the air quality

measurement team if in the Contractor's opinion their activities either (1) compromise safety or the team has inadequate safety equipment, or (2) interfere with the Contractor's work. Access may be denied until the disputed situation is decided in writing by the USEPA OSC. The air quality team must schedule its activities near the dredging area, cofferdam area, lagoon-water treatment enclosure, and silt curtain areas with the Contractor in advance.

1.7 Testing Not Included: Equipment (including piping) testing described in these Specifications is not part of the work of this Section.

2.0 SERVICES:

2.1 Payment for Testing:

2.1.1 The Contractor shall furnish the USEPA OSC a schedule of unit costs for collecting and analyzing the samples and making all tests specified in these Specifications. The unit cost shall include all labor, material, and equipment costs and other expenses necessary to perform the item of work as specified.

2.1.2 The testing, sampling schedule and analyses required are described in Part 3.0 EXECUTION.

2.2 Level of Effort: The exact number and kinds of analyses and the number of days the Testing Laboratory will be on site are unknown. Therefore, unit prices are requested. However, the following number of tests may be used for guidance in determining the unit price. The numbers are based on an actual dredging time of twenty days with the water treatment system discharge time being sixty days.

Number of Analyses and Tests

PCB (soils and sediment)	100
PCB (water)	850
Percent Solids (soils and sediment)	100
Turbidity (on site)	250
pH (on site)	200
Total suspended solids	180
Arsenic	180
Lead	310
Mercury	180
Cadmium	310
Chromium	180
Copper	310
Zinc	310
Chloride	130
Sulfate	130
Conductivity	130

Phenol	130
Ammonia	130
Cyanide	130
Oil and Grease	130
Total Organic Carbon	130
Total Organic Chlorine	130
Sodium	130
Iron	130
Manganese	130
Harbor Secchi Disc readings (turbidity)	150

3.0 EXECUTION:

3.1 The sampling locations, frequency, and parameters specified in this Section constitute the basic monitoring program. The USEPA OSC can direct changes to reduce or expand the program as he judges necessary based upon the monitoring results, due to conditions observed in the field, or because of other factors.

3.1.1 Monitoring Program for Waukegan Harbor Dredging:

I. Pre-Dredging Monitoring (Water Samples):

A. For a period of at least 5 days prior to the start of dredging, water samples shall be collected daily at approximately mid-day at the locations listed below. All samples shall be analyzed for the parameters listed in Schedule A of this Monitoring Program for Dredging with the detection limits as specified therein.

1) Approximately 500 ft. east of the west end of Slip No. 3 at mid-channel and mid-depth.

2) Approximately 500 ft. south of the north end of the Harbor in the main channel at mid-channel and mid-depth.

3) At the Harbor emergency potable water intake on the north pier at mid-channel and at mid-depth.

4) The raw water tap inside the water filtration plant.

5) The finished water inside the water filtration plant.

B. At each sampling location, the date and time of collection shall be recorded. For the samples from locations 1) through 3), the water depth, wind speed and direction, wave height, precipitation, vessel traffic, and any unusual conditions shall also be recorded. In addition, a Secchi Disc turbidity reading shall be recorded at locations 1), 2), and 3).

II. Dredging Monitoring in Slip No. 3 Area (Water Samples):

A. Water samples shall be collected at the locations listed below at approximately mid-day of each day dredging is being performed. All samples shall be analyzed for the parameters listed in Schedule A of this Monitoring Program for Dredging with the detection limits as listed therein.

1) Inside the inner curtain of Silt Curtain Number 1, 50 feet from the curtain, at mid-depth and mid-channel.

2) Outside the outer curtain of Silt Curtain Number 1, 50 feet from the curtain, at mid-depth and mid-channel.

3) Approximately 500 feet south of the north end of the Harbor in the main harbor channel at mid-depth and mid-channel.

4) At the Harbor emergency potable water intake on the north pier, at mid-channel and at mid-depth.

5) The raw water tap inside the water filtration plant.

6) The finished water inside the water filtration plant.

B. At each sampling location, the date and time of collection shall be recorded. For the samples from locations 1) through 4), the water depth, wind speed and direction, wave height, precipitation, vessel traffic, location of the dredge, and any unusual conditions shall also be recorded. In addition, a Secchi Disc turbidity reading shall be recorded at locations 1), 2), 3), and 4).

C. If after the first 3 days of continuous dredging the results of the analysis of water samples taken on the first day of dredging have not been received, the dredging operation shall be suspended to await the results of the analysis. Upon receipt, the USEPA OSC will compare the results of these samples with those collected in the pre-dredging monitoring program, making allowance for wave action and weather conditions.
If the USEPA OSC judges that the dredging is not producing unacceptable pollutant increases outside of Silt Curtain Number 1, the dredging shall be resumed. Otherwise, the Contractor and USEPA OSC will attempt to identify and correct the problems or wait for improved weather conditions before dredging is resumed. The USEPA OSC will continue to compare results of the analysis of water samples on a daily basis. If results are acceptable, dredging may continue.

III. Dredging of Main Channel Area 1 - Upper Harbor (Water Samples):

A. Water samples shall be collected at the locations listed below at approximately mid-day each day dredging is being performed.

All samples shall be analyzed for the parameters listed in Schedule A of this Monitoring Program for Dredging with the detection limits as listed therein.

1) Inside of Silt Curtain Number 2, 50 feet from the curtain, at mid-depth and mid-channel.

2) Outside of Silt Curtain Number 2, 50 feet from the curtain, at mid-depth and mid-channel.

3) Outside of Silt Curtain Number 2, 300 feet from the curtain in the main harbor channel at mid-depth and mid-channel.

4) At the Harbor emergency potable water intake on the north pier, at mid-channel and at mid-depth.

5) The raw water tap inside the water filtration plant.

6) The finished water inside the water filtration plant.

B. At each sampling location, the date and time of collection shall be recorded. For the samples from locations 1) through 4), the water depth, wind speed and direction, wave height, precipitation, vessel traffic, location of the dredge, and any unusual conditions shall also be recorded. In addition, a Secchi Disc turbidity reading shall be taken at locations 1), 2), 3), and 4).

IV. Post-Dredging Monitoring (Water Samples) of Slip No. 3 Area:

A. For a period of at least 5 days following the completion of dredging in Slip No. 3 and prior to the removal of Silt Curtain Number 1, water samples shall be collected daily at the locations listed below at approximately mid-day. All samples shall be analyzed for the parameters listed in Schedule A of this Monitoring Program for Dredging with the detection lmiits as listed therein.

1) Inside the inner curtain of Silt Curtain Number 1, 50 feet from the curtain, at mid-depth and mid-channel.

2) Outside the outer curtain of Silt Curtain Number 1, 50 feet from the curtain, at mid-depth and mid-channel.

3) Approximately 500 feet south of the north end of the Harbor in the main harbor channel at mid-depth and mid-channel.

4) At the Harbor emergency portable water intake on the north pier, at mid-channel and at mid-depth.

5) The raw water tap inside the water filtration plant.

6) The finished water inside the water filtration plant.

B. At each sampling location, the date and time of collection shall be recorded. For the samples from locations 1) through 4), the water depth, wind speed and direction, wave height, precipitation, vessel traffic, and any unusual conditions shall also be recorded. In addition, a Secchi Disc turbidity reading shall be recorded at locations 1), 2), 3), and 4).

C. The outer curtain of Silt Curtain Number 1 shall not be removed until the post-dredging monitoring results show that the water concentrations inside of the area have returned to low levels. Samples may have to be taken for more than 5 days depending upon how quickly the water column PCB concentrations return to low levels.

V. Post-Dredging Monitoring (Water Samples) of Main Channel Area 1 - Upper Harbor:

A. For a period of at least 5 days following the completion of dredging in the Main Channel Area 1 - Upper Harbor and prior to the removal of Silt Curtain Number 2, water samples shall be collected daily at the locations listed below at approximately mid-day. All samples shall be analyzed for the parameters listed in Schedule A of this Monitoring Program for Dredging with the detection limits as listed therein.

1) Inside of Silt Curtain Number 2, 50 feet from the curtain, at mid-depth and mid-channel.

2) Outside of Silt Curtain Number 2, 50 feet from the curtain, at mid-depth and mid-channel.

3) Outside of Silt Curtain Number 2, 300 feet from the curtain in the main harbor channel at mid-depth and mid-channel.

4) At the Harbor emergency potable water intake on the north pier, at mid-channel and at mid-depth.

5) The raw water tap inside the water filtration plant.

6) The finished water inside the water filtration plant.

B. At each sampling location, the date and time of collection shall be recorded. For the samples from locations 1) through 4), the water depth, wind speed and direction, wave height, precipitation, vessel

traffic, and any unusual conditions shall also be recorded. In addition, a Secchi Disc turbidity reading shall be taken at locations 1), 2), 3), and 4).

C. Silt Curtain Number 2 shall not be removed until the post-dredging monitoring results show that the water concentrations inside of the area have returned to low levels. Samples may have to be taken for more than 5 days depending upon how quickly the water column PCB concentrations return to low levels.

VI. Post-Dredging Monitoring (Sediment Core Samples):

A. Approximately 5 days after the removal of the silt curtains used during the dredging of the Upper Harbor and "overlap" dredging of Slip No. 3, short (1 to 2 ft. long) sediment core samples shall be taken at the locations shown in Figure 1 of this Monitoring Program for Dredging. Each core shall be individually homogenized and analyzed for PCBs by Aroclor number, and percent total solids. This will result in one PCB and one total solids analysis for each location sampled. The minimum detection limit for PCBs shall be 0.1 mg/kg. PCB concentrations shall be reported on a dry weight basis.

B. For each sample, the date, time, and place of sampling; water depth; length of core retrieved; sediment color, texture (ooze, clay, silt, sand, etc.), and the presence of readily noticeable odor shall be recorded either in the field or laboratory, as appropriate.

MONITORING PROGRAM FOR DREDGING
SCHEDULE A
WATER SAMPLE ANALYSIS PARAMETERS
AND
MINIMUM DETECTION LIMITS

Parameter	Minimum Detection Limit
Turbidity (measured in the field)	1 NTU
PCBs by Aroclor number	0.2 ug/l
Total suspended solids	2 mg/l
Arsenic	2 ug/l
Lead	10 ug/l
Mercury	0.1 ug/l
Cadmium	1 ug/l
Chromium	5 ug/l
Copper	5 ug/l
Zinc	60 ug/l

At least 2 liters of water sample shall be collected for PCB and placed in separate clean glass bottle(s) with aluminum or teflon inserts as lids. Samples for total suspended solids shall be placed in a separate bottle. Samples for heavy metals (lead, cadmium, chromium, copper, and zinc) may be placed in the same plastic or glass bottle and fixed with nitric acid to pH less than 2.0.

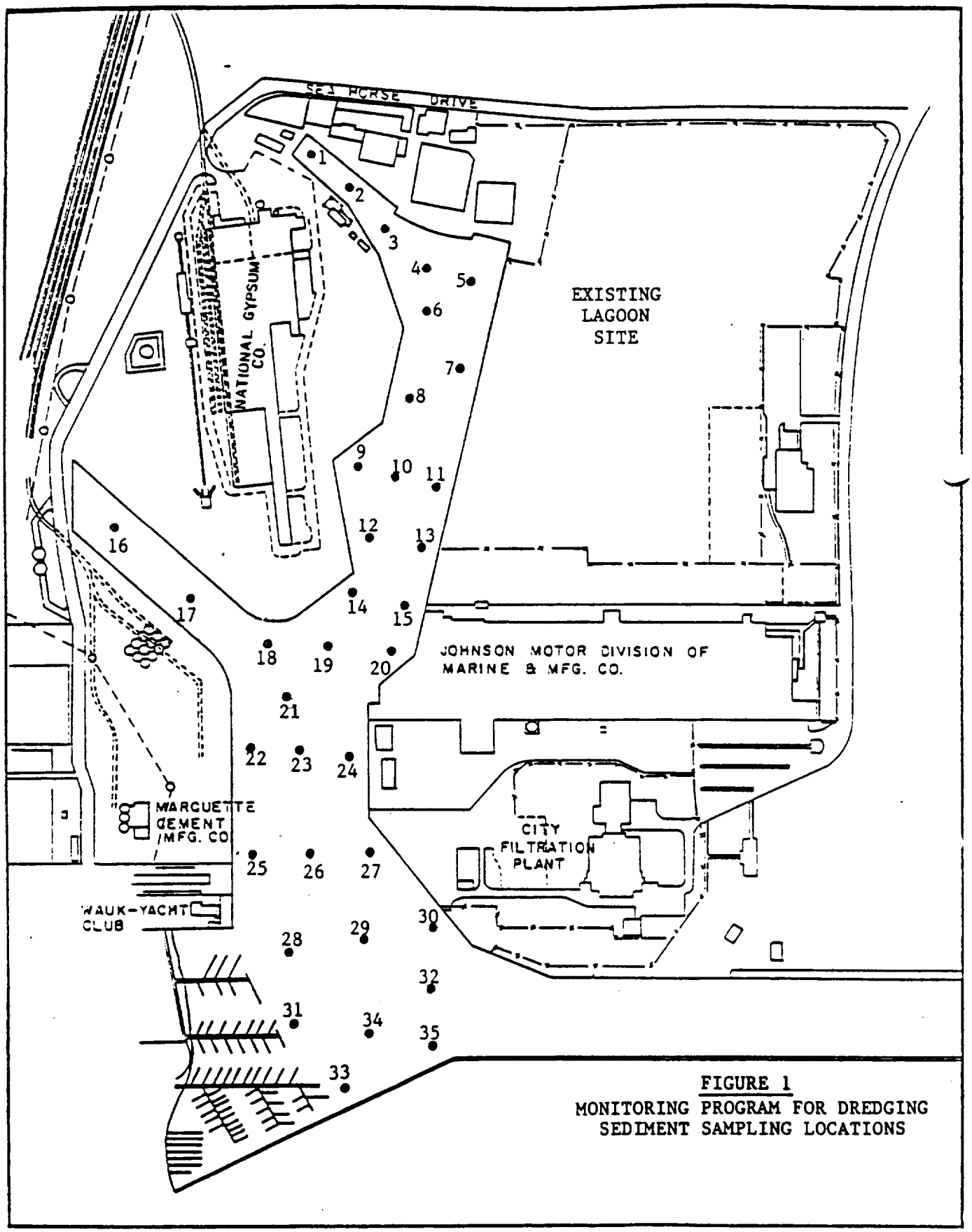


FIGURE 1
MONITORING PROGRAM FOR DREDGING
SEDIMENT SAMPLING LOCATIONS

3.1.2 Groundwater Monitoring Wells:

3.1.2.1 Location: The number and location of the existing wells are shown on the Drawings. The Contractor will be furnished with a key to remove the locking groundwater monitoring well caps.

3.1.2.2 Collection Procedure: The well shall be pumped for at least two minutes before any water sample is collected for analysis in order to flush out any silt. The hose or other apparatus inserted in the well tube for sample withdrawal shall be rinsed with acetone and wiped with a dry cloth between each well sampling in order to avoid cross contamination. The Contractor shall lock the monitoring well caps after collection of the sample.

3.1.2.3 Analyses: The water sample collected shall be divided and placed in separate bottles for analysis as follows:

	Measurement	Collection Procedure
a.	Polychlorinated biphenyls	Collect 2 liters of sample and place in clean bottle(s) with aluminum or teflon inserts as lids. The Laboratory shall compare with the appropriate Aroclor. The Minimum Detection Limit shall be 0.2 ug/l.
b.	Chlorides	One clean glass or plastic bottle, at least 500 mls, can be used for chlorides, sulfates, and conductivity.
c.	Sulfates	Same
d.	Conductivity	Same
e.	pH	Measure on site.
f.	Phenol	Collect 500 mls of sample and place in a clean glass bottle. Add phosphoric acid to pH less than 4.0. Add 0.5 gram of $CuSO_4$.
g.	Ammonia	Collect 500 mls of sample in a clean glass or plastic bottle and decrease the pH to 2.0 or less using sulfuric acid.

h.	Cyanide	Collect 500 mls of sample in a clean glass or plastic bottle and increase the pH to 12 using NaOH.
i.	Oil and Grease	Collect 1,000 mls of sample and placed in a clean glass bottle with aluminum or teflon inserts as lids. Add sulfuric acid to drop the pH to less than 2.0.
j.	Total Organic Carbon	Collect at least 50 mls and place in glass or plastic bottles. Cool (4° C) or add HCl to pH less than 2.0.
k.	Total Organic Chlorine	Collect 2 liters of sample and place in clean glass bottle(s) with aluminum or teflon inserts as lids.
l.	Sodium	One clean glass or plastic bottle (the same bottle used for chlorides, etc. can be used for sodium).
m.	Iron	Collect in plastic or glass bottle; add HNO_3 to pH less than 2.0.
n.	Manganese	Same as iron.
o.	Heavy Metals (copper, zinc, lead, cadmium)	Same as iron; collect at least 100 ml for each metal analyzed.

3.1.2.4 Schedule: Water samples from each monitoring well shall be taken at the following times subject to modification by the USEPA OSC:

a) Samples from each monitoring well shall be taken on at least 5 different days prior to the placement of Slip No. 3 contaminated material into the lagoon.

b) Samples shall be taken daily from each monitoring well once contaminated material is placed in the lagoon, even if dredging does not take place on that day, for a period of seven (7) days.

c) For the period of 7 days to the date of completion of dredging of Slip No. 3, samples shall be taken twice a week.

d) From the date of completion of dredging of Slip No. 3 to the date of beginning of Upper Harbor dredging, samples shall be taken at monthly intervals, weather permitting.

e) During the Upper Harbor dredging and until removal of the 1,500 GPM water treatment system, samples shall be taken at weekly intervals.

f) Thereafter, samples shall be taken at monthly intervals until all contaminated material is removed from the lagoon or until July 31, 1985, whichever comes first.

3.1.3 Leachate Monitoring System:

3.1.3.1 Analysis: The Testing Laboratory with the Contractors assistance shall collect water samples from the leachate monitoring system sump shown on the Drawings. The samples collected shall be divided and placed in separate bottles for analysis as set out in paragraph 3.1.2.3 of this Section. (Analyses: Groundwater Monitoring Wells)

3.1.3.2 Schedule: Samples should be taken on at least 5 different days prior to the placement of Slip No. 3 contaminated material in the lagoon. Thereafter, samples shall be taken on the same schedule as set out for Groundwater Monitoring Wells in paragraph 3.1.2.4 of this Section.

3.1.4 Underdrain System Monitoring: The underdrain system is to be used as an aid in final dewatering of the lagoon. Therefore, sampling of the underdrain is not required. The underdrain sump valve is to remain closed until final dewatering is started or until an emergency removal of lagoon water is required.

3.1.5 Water Treatment Plant Effluent Monitoring: The treated water effluent to be returned to the Harbor shall be sampled for PCB content, pH, and turbidity. The USEPA has directed that any water returned to the Harbor shall contain not more than one part per billion (1 ppb) or 1 ug/l of PCB. The Testing Laboratory shall furnish sampling equipment for collecting 24-hour composite water samples from either the carbon adsorber effluent or the clearwell in accordance with Section 01850: MAINTENANCE AND OPERATIONS and Section 11230: PACKAGED WATER TREATMENT SYSTEM. The sample size shall not be less than two (2) liters. The sample shall be collected in clean glass bottles. The glass bottles shall be capped with covers with aluminum foil or teflon inserts. The Testing Laboratory or Contractor shall collect the samples and have them analyzed for PCB (appropriate Aroclor) within 24 hours. Turbidity and pH measurements shall be done on site. The PCB analysis shall be done by the Testing Laboratory.

3.1.6 Additional Tests on Water Treatment Process: The Contractor may be required to complete additional sampling on the water treatment process. These tests would be of a trouble shooting nature if the treated

effluent marginally approaches or even exceeds 1 ppb of PCB, or if turbidity is ever measured in the treated effluent. Additional samples may have to be collected from the sedimentation basin and analyzed for PCB, turbidity, and/or suspended solids. Further details are presented in Section 01850: MAINTENANCE AND OPERATIONS, paragraph 3.15.

3.1.7 Cofferdam Soils and Sediment Testing: To insure removal of PCB contaminated sand and clay from within the working area of the cofferdam, testing as set out in Section 02380: COFFERDAM will be required. The earth materials are to be analyzed for PCB ("as is" basis) and the results reported to the USEPA OSC and Contractor within 24 hours of the time of sampling. The Testing Laboratory will report the percent solids and the PCB analysis on a dry weight basis to complete the analysis.

3.1.8 Additional Soils and Sediment Testing: The Contractor may be directed by the USEPA OSC to collect soil samples if a spill occurs during operations. The Contractor may also be directed to sample contaminated sediments contained within the lagoon, or to sample sediments in sumps and basins. These samples will be analyzed for PCB, percent solids, and possibly for other parameters.

3.2 PCB Analyses:

3.2.1 Sample Containers: All samples for PCB analysis shall be placed in clean glass containers with aluminum or teflon inserts as lids. The glass container shall be cleaned by rinsing with reagent grade acetone followed by a distilled water rinse, air dried, and lid screwed securely in place (aluminum or teflon insert inside) before delivery to the job site. The sample container shall be rinsed at least twice with the water being sampled before collecting the water sample. At least 2 liters of water shall be collected in the case of a water sample as analysis techniques require detection down to a level of 0.2 part per billion (0.2 ug/l) of PCB expressed in terms of the appropriate Aroclor. The water sample(s) shall completely fill the container. At least 200 grams of solid sample shall be collected per analysis. Solid or sludge-like sample PCB detection limits shall be 0.2 milligrams per kilogram of dry weight. The Testing Laboratory shall supply all containers.

3.2.2 Reporting Results: The Testing Laboratory shall report PCB results of all water samples in concentration units of micrograms per liter (ug/l) of the appropriate Aroclor. Solid samples (including sediments) shall be reported on a dry weight basis in concentration units of milligrams per kilogram of dry weight (mg/kg). The Testing Laboratory shall obtain standards of Aroclor 1242, 1248, 1254, and 1260 to compare with gas chromatograph readings of the unknown sample.

3.2.3 Analysis Procedures - Water:

3.2.3.1 Testing of PCBs in water shall be conducted in accordance with "Sampling and Analysis Procedures for Screening Industrial Effluents and Priority Pollutants" Method 608 USEPA Effluent Guidelines

Division, March 1977. The method 608 revision listed in Federal Register of 3 December 1979 is acceptable.

3.2.3.2 The Testing Laboratory may be directed by the USEPA OSC to determine both total PCB and soluble PCB. In that case, the Testing Laboratory shall collect two separate two liter samples. The Testing Laboratory shall pass one sample through a 0.45 micron filter to remove suspended solids in order to complete a filtered water analysis for PCB. The second sample is analyzed on an "as is" basis. The filtration step may be performed in the laboratory rather than on site.

3.2.4 Analysis Procedures - Soils and Sediments:

3.2.4.1 For 24 Hour Turnaround:

3.2.4.1.1 The Testing Laboratory shall adhere to the following procedure when collecting soils (sand and clay) samples when a 24 hour turn around is required:

(1) At least 200 grams of sample shall be placed in wide-mouth clean glass containers with aluminum foil or Teflon inserts in the lids.

(2) The sample collected shall be uniform in appearance (e.g. all sand, all wood material, all oil-contaminated, etc. and not mixed). Non-uniform samples will result in analysis delays because the analysis must be performed on a homogeneous sample.

3.2.4.1.2 The Testing Laboratory shall use the following procedure in determining the "as is" PCB concentration. (The estimated time to perform this analysis is 4 to 6 hours). Report the results immediately.

(1) Remove any stones or debris greater than about 1/4 inch diameter from the sample. Mix or stir the remaining sample to insure homogenity. Remove a 50 gram sample for the "as is" analysis and save the remainder for the dry weight analysis.

(2) Wet the 50 gram sample with a suitable wetting agent (e.g. 15 ml of 2 percent ammonium chloride).

(3) Mix sample with 100 ml of a suitable solvent (e.g. 50/50 acetone-hexane) and place on a shaker for two hours to extract the PCBs. Suspended solids may need to be removed from the solvent prior to introduction of the sample to the gas chromatograph.

(4) Inject the solvent laden with PCB into a gas chromatograph fitted with an electron capture detector and compare with an appropriate Aroclor as a standard.

3.2.4.1.3 The Contractor shall take the "as is" PCB concentration furnished by the Testing Laboratory and calculate a tentative dry weight PCB concentration using the following assumed values for percent solids:

Dry Sand	90 percent solids
Wet Sand	75 percent solids
Mud	50 percent solids
Wood	40 percent solids
Wet Organic Material	20 percent solids

3.2.4.1.4 The Contractor shall immediately report to the USEPA OSC the results of the "calculated tentative dry weight basis" determination. These results will be used to determine the limits of excavation or disposition of the material from which the representative sample was taken. Four copies of tentative dry weight basis calculation shall be submitted to the USEPA OSC.

3.2.4.1.5 The "as is" PCB concentration results shall be followed by a Testing Laboratory report of the results of the percent solids content (air dry) analysis which shall contain the actual percent solids, the actual PCB dry weight basis, and the other information required in this Section for reporting soil PCB analysis. Dry weight shall be measured by drying the sample under ambient conditions, a procedure which can take one week.

3.2.4.2 If a 24 hour turn around is not required, the Testing Laboratory may analyze the "as is" PCB concentration and percent solid content and report the result in terms of mg/kg of the appropriate Aroclor on a dry weight basis when both measurements are complete.

3.2.5 Quality Assurance Program for PCB:

3.2.5.1 USEPA OSC Approval Before Work Begins: Before the Testing Laboratory takes any samples for PCB analysis, the Testing Laboratory must complete the following assay tests on reproducibility of reference samples: These test results shall be submitted to the USEPA OSC for approval before samples are collected at the site.

a) The Testing Laboratory is to prepare (1) a water sample free from PCB and (2) a soil sample free from PCB. Tap water which has passed through a carbon column and stored in a large glass container may serve as the water sample. Potting soil or peat sold at garden supply stores may serve as the soil sample. The soil sample should be sterilized by autoclaving at at least 215 degrees F for 6 hours and then tested to insure there is no detectable PCB. The percent moisture of the soil sample should be determined.

b) The water sample is then to be spiked with Aroclor 1242 to give a known concentration between 3 ug/l and 10 ug/l. The soil sample is likewise spiked with Aroclor 1242 to give a known concentration between 100 mg/kg and 200 mg/kg (dry weight basis). The soil sample should be mixed in a closed container to insure uniformity before analysis begins. Aroclor 1242 can volatilize to the atmosphere from water and soil samples so care must be taken.

c) The Testing Laboratory is to complete 4 assays per day for a period of 4 days on each of the two samples (16 water analyses and 16 soil samples) to show reproducibility. These results are to be submitted to the USEPA OSC for approval before actual samples are analyzed. Additional samples are to be retained for later assay during the Work. Samples should be stored in clean glass bottles with aluminum or teflon insert as lids. These will be known samples for future tests described below.

3.2.5.2 Quality Assurance Tests During Waukegan Harbor Work: After every 25th water sample and after every 25th sediment or soil sample collected in conjunction with the Waukegan Harbor work, the Testing Laboratory shall complete the following:

a) Run a PCB analysis on a known sample.

b) Run a solvent blank through the gas chromotograph.

c) Run a duplicate assay on one of the previous 25 samples.

d) Spike one of the previous samples which show measureable PCB and run an analysis calculating percent recovery. The sample should be spiked with a known amount of whatever Aroclor was found to be initially present, enough to increase the PCB concentration by at least 50 percent.

e) Supply the USEPA OSC with gas chromatograph tracings of all PCB analyses when work is complete or when otherwise requested.

3.3 Soil Testing Services required are set out in Section 02380: COFFERDAM and include "maximum density at optimum moisture content" determinations and "field density" determinations.

3.4 Concrete Testing Services required are set out in Section 03300: CAST-IN-PLACE CONCRETE and include compression test cylinders, slump tests, and air-entrainment tests.

WARZYN ENGINEERING INC

LOG OF TEST BORING

Project: SAND Sample Collection Waukegan Harbor Slip #3

Location: 45'SE of NW End of Slip & 5'SW of Retaining Wall

Boring No. B1

Surface Elevation 2.33' below B.M.

Job No. C 9560

Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE No.	Type	Recovery	Moisture	N	Depth	VISUAL CLASSIFICATION and Remarks
					5	WATER to 9.8 feet
					10	Very Loose, Black, Organic Clayey SILT, Trace Fine Sand (Muck) (OL)
1	SS	15	W	14	15	Medium Dense, Gray Fine to Coarse SAND, Some Fine Gravel, Little Silt, Very Oily (SW-SM)
2	SS	17	M	33		*
					20	End Boring at 18.0'
					25	* Very Stiff, Gray, Silty CLAY, Little Fine to Coarse Sand, Little Fine to Coarse Gravel. Very Oily
					30	
					35	
					40	

SOIL PROPERTIES

q_u	W	LL	PL	D

WATER LEVEL OBSERVATIONS

While Drilling

Upon Completion of Drilling

Time After Drilling

Depth to Water

Depth to Cave In

GENERAL NOTES

Start 11/22/80 Complete 11/22/80

Crew Chief SL Rig 55-2

Drilling Method CS 14.2' to 18.0'

WARZYN ENGINEERING INC

LOG OF TEST BORING

Project: SAND Sample Collection
Waukegan Harbor Slip #3
Location: 83'SE of NW End of Slip & 44'SW of Retaining Wall

Boring No. B2
Surface Elevation 2.14' below B.M.
Job No. C 9560
Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE No.	Type	Recovery ↓	Moisture ↓	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu	W	LL	PL	D
						WATER to 7.5 feet					
					10	Very Loose, Black, Organic Clayey SILT, Some Fine Sand (Muck) (OL)					
1	SS	15	W	15		Medium Dense, Gray Fine SAND, Some Silt (SM)					
2	SS	10	W	13	15	*					
3	SS	16	M	28		**					
					20	End Boring at 19.3'					
					25	* Medium Dense, Dark Gray to Black Fine to Coarse SAND, Some Fine Gravel, Little Silt (SW-SM)					
					30	** Very Stiff, Gray Silty CLAY, Little Fine to Coarse Sand, Trace Fine to Coarse Gravel					
					35						
					40						

WATER LEVEL OBSERVATIONS

While Drilling
Upon Completion of Drilling
Time After Drilling
Depth to Water
Depth to Cave In

GENERAL NOTES

Start 11/21/80 Complete 11/21/80
Crew Chief WG Rig 55-2
Drilling Method CS 11.75' to 19.3'

3.17.2.3 It is essential that the polymer be sufficiently mixed with the incoming sedimentation basin water in order to be effective. The correct dosage and type of polymer is also important in settling turbidity in the sedimentation basin.

3.17.3 Floating Oil: The Contractor should not experience any floating oil, either in the lagoon, sedimentation basin or clearwell. However, the possibility exists of uncovering a pocket of contamination during dredging operations which could result in floating oil in the lagoons. The water treatment system is designed to remove limited oil, but a different polymer or more extensive filter backwashing may be required.

3.17.4 pH Out of Specification:

3.17.4.1 The Contractor should not experience water having a pH outside the range of 6.0 to 8.5. However, the remote possibility exists that acid or alkali may be transferred to the lagoons during dredging operations. In addition, the lagoon underdrain water pH could decrease below 6.0 as the result of biological activity. The Contractor should notify the USEPA OSC if this condition is encountered.

3.17.4.2 Corrective action will involve addition of a suitable acid or alkali to the sedimentation basin and pumping the water back to the lagoon until the lagoon water pH is within acceptable limits. If the lagoon underdrain water pH is low, the 200 GPM water treatment system shall be batch operated with alkali being added as required. The Contractor should consult with USEPA OSC for procedures before attempting corrective action.

3.17.5 Hydrogen Sulfide Odors: There is a remote possibility that noticeable hydrogen sulfide odors will be encountered during dredging operations, during storage in the lagoon, or during final removal of stored sediments from the lagoon. The Contractor shall consult with USEPA OSC for procedures before attempting corrective action. Corrective action could involve addition of hydrogen peroxide to the sedimentation basin and pumping this water back to the lagoon or addition of hydrogen peroxide at some point in the treatment step before final discharge to the Harbor.

3.16.2 When all contaminated materials have been removed from the lagoon, the Contractor shall remove the 200 GPM system.

3.16.2.1 Intake tower pumps, and piping and valves used to transport contaminated water from the intake towers to the sedimentation basin shall be removed, cleaned and flushed with potable water.

3.16.2.2 Cleaning water and sediment shall be placed in the sedimentation basin along with the clean-up water from the leachate sumps and piping, underdrain sumps and piping, and the equipment pad sumps and piping. Liquid polymer shall be added to settle solids and the remaining portion of the 200 GPM system shall be batch operated.

3.16.2.3 The Contractor should coordinate with others for the disposal of spent filter media and spent activated carbon.

3.16.3 All other equipment that is exposed to the contaminated material shall be cleaned in accordance with Section 01030: SPECIAL PROJECT PROCEDURES.

3.17 Troubleshooting Substandard Water:

3.17.1 Treated Water Over 1 ppb of PCB:

3.17.1.1 The most likely causes of PCBs exceeding 1 ppb are: excessive turbidity to the carbon adsorbers; channeling in the carbon adsorbers;, or contaminated solids accidentally spilled in the clearwell.

3.17.1.2 The Contractor should check the turbidity of the water going to the carbon adsorber and to the clearwell. If the turbidity is acceptable, the Contractor should sample the effluent from each carbon adsorber and from the clearwell for PCB analysis. If one of the carbon adsorbers shows excessive PCB in the effluent water, this carbon adsorber should be taken off line and a spare carbon adsorber placed in service. If the clearwell PCB level is unacceptable but the effluent from each carbon adsorber is acceptable, contamination in the clearwell is the most likely cause. The Contractor should then cease water treatment operations and clean out the clearwell.

3.17.2 Excessive Turbidity:

3.17.2.1 The most likely causes of excessive turbidity are an improperly working filter, or improperly coagulated suspended solids in the sedimentation basin.

3.17.2.2 The Contractor should measure the turbidity in the sedimentation basin, clearwell and effluent from each filter in an attempt to isolate the source. Changes in filter backwashing methods may be required as a corrective measure.

3.14.7 Portable pumps with hoses may also be used to transfer lagoon surface water which has accumulated in pockets to the lagoon intake tower or to the sedimentation basin.

3.14.8 The Contractor should provide at least two such portable pumps and hoses rated at 75 to 100 GPM each to transfer water from underdrain sumps or from the lagoon.

3.14.9 When the sedimentation basin pump shuts down due to low water level in the sedimentation basin (insufficient water supply) the water treatment system shall then be batch operated.

3.15 Batch Operation of 200 GPM Water Treatment System:

3.15.1 When the Contractor can no longer supply 200 GPM to the sedimentation basin, the water level in the sedimentation basin will drop and the level control will shut the pump off; thus, stopping flow through the 200 GPM packaged water treatment system and to the clearwell. At this point the sedimentation basin pumps should be operated manually to allow the basin to fill.

3.15.2 During batch operation, polymer is fed to the sedimentation basin when intake tower pumps, underdrain pumps, and leachate pumps operate. The liquid polymer can be diluted 1 part Nalco 8103 to 100 parts water and pumped at the rate of 5 gallons per hour to the sedimentation basin. The Contractor shall adjust the dilution and dosage as necessary to obtain suspended solids settling.

3.15.3 When the sedimentation basin is full; the intake tower pump, underdrain and leachate pumps shall be shut off; and the sedimentation basin pump shall be started and water processed through the 200 GPM packaged water treatment system. Effluent from the carbon adsorber shall be sampled, in accordance with the procedures set out in paragraph 3.5 of this Section, and returned to the sedimentation basin until the effluent samples show compliance with the acceptable water quality set out in paragraph 3.13.8 of this Section. The effluent may then be discharged to the clearwell until the sedimentation basin pump cut-off level is reached. The sedimentation basin is again filled and the cycle repeated.

3.15.4 Clearwell water is to be discharged to the Harbor or can be used for filter backwash. Storage of water in the clearwell is permitted until such time as clearwell cleanout procedures are required.

3.16 Operation of the 200 GPM Water Treatment System During Removal of Contaminated Sediments:

3.16.1 During the removal of contaminated material from the lagoons the Contractor shall remove and treat water from the lagoon using both continuous and batch operation of the 200 GPM system in accordance with this Section.

3.13.6 The Contractor shall supply the USEPA OSC with four copies of the results of the PCB analyses of the daily composite samples and two copies of the results of all pH and turbidity measurements of the grab samples.

3.13.7 When the USEPA OSC is satisfied that stable operation is achieved and water quality is acceptable, the Contractor, with USEPA OSC approval, can fill the clearwell and discharge the clearwell contents to the Harbor.

3.13.8 The USEPA OSC in cooperation with the Illinois EPA will ultimately decide on the criteria for water discharged to Waukegan Harbor. The following criteria may be used to determine acceptable water quality.

PCBs (24 hr composite)	less than one part per billion
pH	6 to 8.5
Turbidity	less than 2 Nephelometric Turbidity Units) (NTU)

No visible oil sheen in clearwell
No floating material in clearwell
Additional parameters may be added

3.14 Continous Discharge of 200 GPM Water Treatment System Water for Use During Removal of Contaminated Sediments:

3.14.1 The Contractor shall continue to process water on a 24 hour per day, 7 day per week basis, backwashing individual filters when necessary. The water in the lagoon is treated this way.

3.14.2 The clearwell composite sampler shall collect daily samples of clearwell water to be analyzed for PCB and four copies of the results of the PCB analyses shall be furnished the USEPA OSC.

3.14.3 The Contractor shall keep track of the water depth in the lagoon at the intake tower, drawing off as much surface water as possible without allowing settled sediments to slop over into the intake tower.

3.14.4 If one of the tower intake valves is buried less than 6 inches into the settled sediment, the valve may be then opened allowing some sediments to slop over in order to remove as much water as practical.

3.14.5 Finally, when as much lagoon surface water as practical is removed, the underdrain sumps shall be used to transfer water to the sedimentation basin.

3.14.6 The Contractor may use portable supplemental pumps and non-leaking flexible hoses to transfer water from the underdrain sumps to the sedimentation basin during the initial stages of dewatering in order to maintain 200 GPM flow to the sedimentation basin.

3.12.1.3 Each valve and pump in the system shall be checked and any leaks shall be repaired.

3.12.1.4 Piping and valves from the lagoon intake structures to the sedimentation basin shall be visually inspected for proper alignment and fit.

3.12.2 The procedure described in Paragraph 3.12.1 shall be followed before starting the 200 GPM system for either batch or continuous operation.

3.12.3 Water shall not be discharged to the Harbor during the checkout unless otherwise directed in writing by the USEPA OSC.

3.13 Demonstration Test for Continuous Operation of the 200 GPM Water Treatment System: Before any treated water is discharged to Waukegan Harbor, the Contractor must demonstrate to the OSEPA OSC that the clearwell water will contain less than 1 ppb of PCB. Effluent from this demonstration test shall be tested to insure compliance.

3.13.1 After hydraulic checkout of the 200 GPM water treatment system, the Contractor may start pumping water from the lagoon to the sedimentation basin. Polymer feed pump should be operating, adding enough cationic polymer to coagulate and settle turbidity. Based on bench scale tests, the liquid polymer can be diluted 1 part Nalco 8103 to about 25 parts water and pumped at the rate of 5 gallons per hour into the sedimentation basin. The Contractor shall adjust the dilution and dosage as necessary to obtain suspended solids settling. The sedimentation basin pump should start automatically when the water level rises. The water from the sedimentation basin is pumped at 200 GPM through the filters and carbon adsorbers with the effluent from the carbon adsorbers being returned to the lagoon.

3.13.2 If leaks are discovered in piping or valves between the intake structure and the sedimentation basin, then pumping shall be discontinued until all leaks are repaired.

3.13.3 When withdrawing water from the lagoon, the Contractor shall open the valves on the lagoon intake tower down to (but not below) the level of the sludge.

3.13.4 The carbon adsorber effluent shall be sampled to obtain a 24-hour composite sample which shall be analyzed for PCB as described in Section 01400: TESTING LABORATORY SERVICES.

3.13.5 In addition, the Contractor shall collect grab samples at 0600 hours, 1200 hrs, and 2400 hours from the carbon adsorber effluent to make pH and turbidity measurements. These measurements shall be done by the Contractor on site. The Contractor shall keep a record of all measurements.

3.10 Removal of contaminated solids from the lagoon, removal of the clearwell, sedimentation basin, equipment pads, and all sumps will be done by others.

3.11 Operation of the 200 GPM Water Treatment System:

3.11.1 The 200 GPM water treatment system shall be installed concurrent with or immediately following the removal of the 1500 GPM water treatment system. The 200 GPM system will be used: to treat water resulting from rain, snow, and sleet; to treat lagoon underdrain water before removal of the contaminated sediments from the lagoon; to treat lagoon underdrain water during removal of the contaminated sediments; and to treat water that accumulates in the lagoon leachate system.

3.11.2 The 200 GPM water treatment system shall remain on-site and be operable throughout the period of time that the contaminated material is stored in the lagoon. During this period of time, both batch and continuous operation of the 200 GPM system will be required.

3.11.3 When the water level in the lagoon reaches elevation 609 feet, the USEPA OSC may direct that the 200 GPM system be operated to treat water from the lagoon until the water level returns to an elevation which is approximately six inches above the top of the stored sediments. However, operation of the 200 GPM system shall be required when the water level reaches elevation 611 feet.

3.11.4 The Contractor shall be responsible for coordinating the maintenance and operation of the 200 GPM system with others during the removal of the contaminated materials from the lagoon and shall schedule the water treatment to avoid delays in the removal process.

3.12 Hydraulic Checkout of the 200 GPM System:

3.12.1 Before the 200 GPM water treatment system processes water from the lagoon the Contractor shall check the system for leaks and verify that all pumps, except the lagoon intake tower pumps, are in working order.

3.12.1.1 After closing the drain valves in the sedimentation basin and in the clearwell, the previously cleaned sedimentation basin shall be filled with potable water. The sedimentation basin pumps are then started and pump water through the 200 GPM packaged treatment system to the previously cleaned clearwell. Clearwell pumps will be alternately operated to transfer water to the sedimentation tank and to provide water for backwashing each filter of the packaged treatment system. Filter backwash is to be routed to the lagoon.

3.12.1.2 Water from the sedimentation basin and the clearwell shall then be pumped to the lagoon.

pumps. A high pressure water jet (using fire hydrant water) may be used to dislodge the accumulated sediment. The material can then be pumped back to the lagoon or to a tank truck using sedimentation basin pumps.

3.8.3.3 The sedimentation basin shall be flushed with clean water (fire hydrant water) after sediment has been removed and then pumped dry. It may be necessary to flush away additional sediment missed during this time.

3.8.3.4 After the sedimentation basin has been cleaned out and pumped dry, the basin may be entered and inspected for leaks. If any leaks or possible leaks are found, the sedimentation basin shall be repaired. The location of any leaks should be noted. The Contractor shall notify the EPA of any potential leak found so that soils adjacent to the leak location can be tested for PCB (by others) after the sedimentation basin is removed. The baffle panel is to be replaced if the sedimentation basin is to be reused.

3.8.4 Clearwell: Cleanout of the clearwell consists of pumping the clearwell water to the Harbor, flushing with potable water which will be pumped to the Harbor, and opening the clearwell drain valve if the tank is not to be reused after cleanout.

3.9 Cleanout and Maintenance of Sumps:

3.9.1 The Contractor is responsible for all maintenance of sumps consisting of: leachate, underdrain, equipment pad, and building floor sump if provided.

3.9.2 Cleanout of each sump shall be done once a year before freezing weather, after any major spill, after operation of the 200 GPM system, and at the time of final removal of the 200 GPM system.

3.9.3 Cleanout consists of flushing and removal of any accumulated solids, transferring the solids and water to the lagoon or sedimentation basin or to a tank truck. After operation of the 200 GPM system before removal of the water treatment system, the sedimentation basin should be filled with potable water and this water processed through the water treatment system.

3.9.4 The pads and sumps shall be flushed with potable water after cleanout.

3.9.5 Each year before freezing weather and after cleanout the equipment pad sumps shall be filled with a 50-50 solution of ethylene glycol and water. The ethylene glycol used shall not contain any chromate or zinc. The leachate and underdrain sumps shall be pumped dry and covered.

3.9.6 Removal of all sumps, procurement of the tank truck, and disposal of the tank truck contents is the responsibility of others. The tank truck is used during removal of sedimentation from the lagoon. The Contractor should coordinate his activities with others during the removal of contaminated materials from the lagoon.

3.6.9 Criteria for water being discharged to the Harbor is discussed in paragraph 3.5.8 of this Section.

3.7 Removal of 1500 GPM Water Treatment System:

3.7.1 When dredging of the Upper Harbor is complete and excess water has been treated, the Contractor shall remove the 1500 GPM water treatment system, exclusive of the equipment that will be used for the 200 GPM water treatment system. The filter media and spent carbon shall be placed in the lagoon. The pads upon which the water treatment system rests shall be flushed with water to wash contaminated material to the sumps and this wash water shall be pumped from the sumps to the lagoon. The equipment pad sumps shall be flushed out and the material transferred to the lagoon.

3.7.2 If the Contractor elects to leave part or all of the 1500 GPM system on site over a winter period, he must drain the water from the treatment basins, piping, filters and carbon adsorbers to protect against freezing.

3.7.3 The Contractor should note that the sedimentation basin, clearwell, polymer system and some of the pumps and piping used for the 1500 GPM are also used for the 200 GPM system and therefore should not be removed from site until all contaminated sediment is removed from the lagoon.

3.7.4 The Contractor may elect to use filters and carbon adsorbers which form part of the 1500 GPM system for the 200 GPM water treatment system. If this is done, the Contractor is responsible for sizing pumps and piping to be compatible with the rest of the system.

3.8 Cleanout and Maintenance of Sedimentation Basin and Clearwell:

3.8.1 The Contractor is responsible for all maintenance of the sedimentation basin and clearwell.

3.8.2 Cleanout shall be done once a year before freezing weather and again after operation of the 1500 GPM treatment system and after operation of the 200 GPM treatment system. However, the USEPA OSC may direct the Contractor to start the 200 GPM system immediately after operation of the 1500 GPM system is complete, foregoing cleaning of the sedimentation basin and clearwell at that time.

3.8.3 Sedimentation Basin:

3.8.3.1 The Contractor shall clean out the accumulated solids in the sedimentation basin, transferring the solids and water back to the lagoon (or to a tank truck during final cleanout after lagoon solids have been removed).

3.8.3.2 Cleanout of the sedimentation basin may be accomplished by removing the baffle panel at the end of the sedimentation basin nearest the

PCBs (24 hr composite)	less than one part per billion (ppb)
pH	6 to 8.5
turbidity	less than 2 NTU

No visibile oil sheen in clear well
No floating material in clear well
Additional parameters may be added

3.6 Discharge of 1500 GPM Water Treatment System Water:

3.6.1 The Contractor shall continue to operate the water treatment system on a 24 hour per day-7 day per week basis, backwashing individual filters when necessary. The water treatment system must not shut down unless shutdown is necessary to make repairs or to clean out the clearwell. If substandard water is obtained, clearwell pumps should pump the water back to the lagoon and the water treatment system continue to operate until water of satisfactory quality is obtained. If the water treatment system must be shut down, the USEPA OSC may elect to have the Contractor complete another demonstration test before treated water can be discharged to the Harbor.

3.6.2 When the lagoon water level drops below elevation 611 feet, the Contractor may start the dredging operation to refill the lagoon to a level not to exceed elevation 611 feet. The water treatment system should continue to withdraw water from the lagoon at the same time it is being filled. (See Section 02881: DREDGING).

3.6.3 The Contractor shall schedule operations to maintain the water level in the lagoon between elevations 607 and 611 feet.

3.6.4 If the Contractor is unable to refill the lagoon with dredge material when the lagoon water level drops to elevation 607 feet, the Contractor should continue withdrawing water at 1500 GPM for the water treatment system. The valves on the intake tower should be opened down to the sediment level to permit water to enter the intake tower. When dredging resumes, these valves should be closed as the lagoon fills to the normal operating levels.

3.6.5 When dredging is complete, the Contractor should open all valves to within six inches above the sediment level and continue withdrawing and treating water at 1500 GPM until that water level is reached.

3.6.6 Water being discharged to the Harbor shall be sampled in the clearwell by use of a composite sampler. Samples for testing shall be 24-hour composite samples.

3.6.7 The clearwell turbidity analyzer system shall be in operation while water is being discharged into the clearwell.

3.6.8 The Contractor shall supply the USEPA OSC with four copies of the results of the PCB analyses of the daily composite samples and two copies of the results of all pH and turibdity measurements.

3.5.2 After hydraulic checkout of the water treatment system, dredging of the Upper Harbor may begin. The Contractor shall fill the lagoon until the water level reaches about elevation 608 feet. The intake tower slide gate will then be opened and the intake tower will be flooded thus allowing water treatment to begin. The Contractor should start two lagoon pumps and the polymer feed pump and shall inspect the pumps for proper operation and for absence of leakage. Piping to the sedimentation basin shall be re-inspected at this time to insure absence of leakage. The polymer feed pump should pump enough cationic polymer to coagulate and settle turbidity in the sedimentation basin. Based on bench scale tests, the liquid polymer can be diluted 1 part Nalco 8103 to 3 parts potable water and pumped at the rate of 5 gallons per hour into the sedimentation basin. The Contractor shall adjust the dilution and dosage as necessary to obtain suspended solids settling. Sedimentation basin pumps should start automatically when the water depth reaches the preset level. The water from the sedimentation basin should be pumped at 1500 GPM through the filters and carbon adsorbers with the effluent from the carbon adsorbers being returned to the lagoon. Minor adjustment in sedimentation basin level controls may be necessary in order to insure smooth operation. Under no circumstances should the carbon adsorber effluent be allowed to enter the clearwell or the Harbor during the demonstration test.

3.5.3 The Contractor may allow the lagoon water level to reach elevation 611 feet during the demonstration test, at which level the filling of the lagoon shall cease.

3.5.4 The carbon adsorber effluent shall be sampled to obtain a 24-hour composite sample which shall be analyzed for PCB as described in Section 01400: TESTING LABORATORY SERVICES.

3.5.5 In addition, the Contractor shall collect grab samples at 0600 hours, 1200 hrs, 1800 hrs, and 2400 hours from the carbon adsorber effluent to make pH and turbidity measurements. These measurements shall be done by the Contractor on site. The Contractor shall keep a record of all measurements. The turbidimeter monitoring the sand filter effluent shall operate whenever the 1500 GPM system is processing water.

3.5.6 The Contractor shall supply the USEPA OSC with four copies of the results of the PCB analyses of the daily composite samples and two copies of the results of all pH and turbidity measurements of the grab samples.

3.5.7 When the USEPA OSC is satisfied that stable operation is achieved and water quality is acceptable, the Contractor, with USEPA OSC approval, may fill the clearwell and discharge the clearwell contents to the Harbor.

3.5.8 The USEPA OSC in cooperation with the Illinois EPA will utlimately decide on the criteria for water discharged to Waukegan Harbor. The following criteria may be used to determine acceptable water quality:

3.2 Upon completion of the dredging of Slip No. 3, the Contractor shall ascertain that the contaminated sediment stored in the lagoon is covered by water to an elevation which is at least six inches higher that the highest elevation of the sediment; but, which is less than Elevation 601.0 feet. The maximum water level that shall be allowed to accumulate during the storage period of approximately six months is at Elevation 603.0 feet.

3.3 Prior to beginning dredging in the Upper Harbor, the water treatment system installation shall be completed, all motors and pumps shall be operable and all process piping leak tested in accordance with these Specifications.

3.4 Hydraulic Checkout of the 1500 GPM System:

3.4.1 Before the 1500 GPM water treatment system processes water from the lagoon containing contaminated sediment and water, the Contractor shall operate the system, exclusive of the lagoon intake tower pumps, using potable water.

3.4.2 After closing the drain valves in the sedimentation basin and in the clearwell, the sedimentation basin shall be filled to operating level with potable water. Sedimentation basin pumps should be started in turn with pipeline valves positioned for water to be returned to the lagoon. When the Contractor is satisfied that the pumps are in working order and the pipes do not leak, then the valves should be positioned to permit the potable water to be pumped through the filters and carbon adsorbers to the clearwell. Potable water shall be added to the sedimentation basin as needed. Clearwell pumps should be operated, in turn, pumping potable water to the sedimentation basin. The level controls should be tested to see whether they can initiate starting and stopping of the appropriate pumps. Each filter should be backwashed in turn with the filter backwash water being returned to the lagoon.

3.4.3 The Contractor is responsible for checkout and repair of all pumps, valves, level controls, and piping, exclusive of equipment and piping of the packaged Water Treatment System, and for the checkout and repair of the electrical system. Water shall not be discharged to the Harbor during the checkout period unless otherwise directed by the USEPA OSC.

3.4.4 The Contractor shall make the necessary adjustments in the sedimentation basin and clear well level controls in order to insure smooth operation of the system. Additional adjustments may be required when the intake tower pumps are started during the Demonstration Test.

3.5 Demonstration Test for 1500 GPM Water Treatment System:

3.5.1 Before any treated water is discharged to Waukegan Harbor, the Contractor must demonstrate to the USEPA OSC that the clearwell water will contain less than 1 ppb of PCB. Effluent from this demonstration test shall be tested to insure compliance.

Density	9.09 Lbs./gal.
pH	4.5
Viscosity at 70 degrees F.	900 centipoise
Viscosity at 40 degrees F.	1500 centipoise
Liquid can be diluted with water.	

The liquid cationic polymer shall be Nalco 8103. Other cationic polymers may be acceptable but the substitute shall be tested on sample material from the Harbor to show results equivalent to Nalco 8103.

2.2 This work includes the maintenance and operation of materials and equipment to be furnished and installed in accordance with other Sections. Included, generally, are:

(1) the Intake tower pumps, valves, and all process piping;

(2) the Polymer Feed System;

(3) the Sedimentation Basin Pumps;

(4) the Packaged Water Treatment Systems, complete with filter media and activated carbon;

(5) the Turbidity meters;

(6) the Clearwell pumps;

(7) the Liquid level controls, pump controls and control panel;

(8) the Leachate and Underdrain Sump Pumps;

(9) the electric service to all equipment; and

(10) the electric lighting system.

2.3 Dredge and dredge piping are specified in other Sections.

3. EXECUTION:

3.1 Completion of the installation of pumps and piping is scheduled to run concurrent with the dredging of Slip No. 3. However, the Contractor shall arrange to have the Leachate and Underdrain Sump pumps operational and associated piping complete prior to the start of the dredging of Slip No. 3. Piping from the sumps to the sedimentation basin and from the sumps to the lagoon shall be included and shall be checked for leakage. Low water level controls for these pumps shall be operational. Installation of the Polymer Feed system, including piping to the sedimentation basin shall have also been completed.

1.3.2 The Contractor shall provide operating personnel for the 1500 GPM water treatment system on a 24 hour per day - seven day per week basis during the period in which the water treatment system is discharging water to Waukegan Harbor or is recycling water back to the lagoon. For safety reasons at least two people shall be on site at all times. One of the persons shall be a certified operator.

1.3.3 The Contractor shall provide operating personnel on site for the 200 GPM water treatment system during all times in which water is being discharged to the Harbor or is being recycled back to the lagoon. For safety reasons, two people shall be on site at all times during operation.

1.3.4 The Contractor shall provide facility personnel who have been trained in hazardous waste management procedures to ensure that operations on-site comply with the operating permit issued by the Illinois Pollution Control Board. Such personnel shall be on-site during placement of material in the lagoon and during the operation of water treatment systems. In addition, hazardous waste management personnel shall inspect the facility at a frequency set out in a schedule which is to be developed jointly by the Contractor and the USEPA OSC.

1.3.5 When the water treatment systems are not operating all equipment and the lagoon shall be maintained and precautions shall be taken to minimize unauthorized access to the site. A certified operator is not required to be present when the water treatment systems are not operating.

1.3.6 Additional personnel requirements are set out in other Sections of this Specification.

1.4 The 1500 GPM water treatment system will not be operated during freezing weather; thus, neither a building to house the packaged treatment system or heat tracing of process piping is specified.

1.5 A building to house the 200 GPM packaged treatment system is being furnished and installed under another Section; however, heat tracing of process piping is not required in these Specifications.

1.6 Removal of contaminated material from the lagoon is to be performed by others but is to be concurrent with a portion of the work of this Section.

2. MATERIALS AND EQUIPMENT:

2.1 As part of the work of this Section, the Contractor shall supply a liquid cationic polymer for use with the Chemical Feed System specified in Section 15300: SPECIAL PIPING SYSTEMS AND EQUIPMENT. The polymer shall have the following properties:

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01850
MAINTENANCE
AND OPERATIONS

1. GENERAL:

1.1 Description:

1.1.1 This Section includes only; those procedures associated with the removal of polychlorinated biphenyl (PCB) contaminated material from a portion of Waukegan Harbor; storage of the contaminated material in the lagoon; and treatment and return of slurry water and rain water to the Harbor.

1.1.2 Routine maintenance and operation of equipment and piping on the site are not specified herein; BUT, are part of the work of this Section.

1.1.3 Related work described elsewhere:

(1)	Supplementary Conditions	Section 00800
(2)	Special Project Procedures	Section 01030
(3)	Measurement and Payment	Section 01150
(4)	Testing Laboratory Services	Section 01400
(5)	Cofferdam	Section 02380
(6)	Dredging	Section 02881
(7)	Packaged Water Treatment System	Section 11237
(8)	DIVISION 15 - MECHANICAL	
(9)	DIVISION 16 - ELECTRICAL	

1.2 Job Conditions:

1.2.1 The dredging and treatment schedule as required in Section 00800: SUPPLEMENTARY CONDITIONS shall be used in this work. Operations which affect the schedule shall be coordinated with other Sections to insure a safe and continuous performance of the Work.

1.2.2 Operating and Maintenance manuals are required in other Sections of these Specifications for use in this work.

1.3 Personnel:

1.3.1 Operators of the water treatment systems shall possess a Certificate of Technical Competency as an Industrial Wastewater Treatment Works Operator which is issued by the Illinois Environmental Protection Agency.

sufficient heating and/or cooling to maintain a stable temperature under normal weather extremes. Location of the office is subject to the approval of the USEPA OSC. This office shall be removed upon completion of the Work or as otherwise directed.

2.4 Storage of Materials and Parking:

2.4.1 The Contractor shall store all construction materials and shall park all vehicles, including those of the workers, within the limits of the Work as described in Section 00800: SUPPLEMENTARY CONDITIONS.

2.4.2 Storage of Materials and Equipment: Furnish and install proper and adequate storage for all materials and equipment. Keep all materials and equipment locked up and secure during construction. The Owner is not liable for theft or vandalism.

2.5 Enclosures: Furnish, install, and maintain for the duration of construction all required scaffolds, tarpaulins, barricades, canopies, warning signs, steps, bridges, platforms, flotation equipment, and other temporary construction necessary for proper completion of the Work in compliance with all pertinent safety and other regulations.

3. EXECUTION:

3.1 Removal: Maintain all special temporary facilities and controls as long as needed for the safe and proper completion of the Work. Upon completion of the Work, or as directed by the USEPA OSC, remove all special temporary facilities and controls.

2.1.3 Special Temporary Water:

2.1.3.1 The Contractor shall arrange for potable water service by use of a fire hydrant meter and at grade piping.

2.1.3.2 Furnish and install all special temporary piping, pumps, hose, etc., that may be required. Provide maintenance to insure that all leaks are corrected in a timely manner.

2.1.3.3 Drinking Water: The Office for the USEPA OSC shall be provided with an electric water cooler or other suitable means to provide cool drinking water.

2.1.3.4 Project Water: Water required for operations, including site dust control, flushing and cleaning, and filling the lagoon, shall be provided by the Contractor. This water shall be from the potable water source. Under no circumstance shall water from Waukegan Harbor be used for operational purposes.

2.1.4 Telephone Service: The Contractor shall provide for his own telephone service (including a telephone located at the north end of the intake tower bridge) and for a separate line with a separate number to the USEPA OSC field office. The Contractor shall be responsible for routing of the telephone lines subject to the approval of the USEPA OSC.

2.2 Sanitary Facilities:

2.2.1 The Contractor shall furnish, install, maintain and pay for temporary sanitary facilities for the workmen on the site. A separate temporary sanitary facility shall be provided for the USEPA OSC near his/her office.

2.2.2 The existing sanitary sewer on the site shall not be used for disposal of sanitary wastes. No temporary septic tanks, drain fields, etc. shall be constructed on the site.

2.2.3 All sanitary facilities shall be installed in accordance with all State and local health regulations and all facilities shall be removed upon completion of the Work or as directed by the USEPA OSC.

2.3 Field Offices:

2.3.1 The Contractor shall be responsible for providing his own separate field office and/or sheds. The location of this field office shall be subject to the approval of the USEPA OSC.

2.3.2 The Contractor shall provide a separate field office for the USEPA OSC. This office shall be sufficiently large for two desks, two reference tables or two drafting tables, two executive chairs, two straight chairs, one print rack, and two each four-drawer filing cabinets. The office area shall be not less than 26 feet long by 8 feet wide and shall be provided with

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01600
TEMPORARY
FACILITY CONTROLS

1. GENERAL:

1.1 Description:

1.1.1 Work Included: Special temporary facilities and controls required for this Work include, but are not necessarily limited to:

(1) Utilities such as water and telephone;

(2) Sanitary facilities; and

(3) Enclosures such as tarpaulins, barricades, and canopies.

1.1.2 Related Work Described Elsewhere:

1.1.2.1 Compliance with safety regulations: Compliance with all requirements of pertinent regulations is described in the General Provisions.

1.1.2.2 Subcontractor Equipment: All equipment furnished by subcontractors shall comply with all requirements of pertinent safety regulations. The ladders, hoists, planks, flotation equipment, and similar items normally furnished by individual trades in execution of their own portions of the Work are not part of this Section of these Specifications.

1.2 Product Handling:

1.2.1 Protection: Use all means necessary to maintain special temporary facilities and controls in proper and safe condition throughout progress of the Work.

1.2.2 Replacements: In the event of loss or damage, immediately make all repairs and replacements necessary to the approval of the USEPA OSC.

2. MATERIALS:

2.1 Utilities:

2.1.1 General: The Contractor shall provide and pay all costs for all water and telephone service required for the performance of the Work. All special temporary utilities shall be removed upon completion of the Work.

2.1.2 The Contractor shall provide adequate light and power to all construction offices, including the office for the USEPA OSC, the Contractor's office, any sheds, and for use of permanent power tools.

3.6.2 All samples should be kept refrigerated (about 4 degrees C) until the 2 month or 2 week retention time has elapsed. An on site mobile laboratory may arrange for off site storage at 4 degrees C during the holding period. Solid samples (soils and sediments) may be frozen.

c. Field Analytical Methodology for Field Parameters

d. Procedure for calibrating and maintenance of field instruments.

5) Prctocol for establishing standard curves.

6) Specific organic protocol for GC/MS system.

The following should be included:

a. Spectrum validation test protocol.

b. Saturation recovery test protocol.

c. Precision test protocol.

d. Quantitative analysis with liquid-liquid extraction protocol.

e. Quantitative analysis with inert gas purge and trap protocol.

f. Qualitative analysis with real sample protocol.

7) Frequency of duplicate sample analysis to every precision of the method (10 to 20%).

8) Frequency of use of known standards or spikes to verify accuracy of method (10 to 20%).

VIII. Sample Custody: The Testing Laboratory(s) shall keep a record of all personnel and times for collection, transport, and analysis of each sample collected. The record also includes location and temperature of sample storage until all analyses are completed and accepted. Except for these requirements, formal Chain of Custody procedures need not be followed.

3.6 Storage and Disposal of Samples Collected:

3.6.1 The Testing Laboratory shall retain all samples entrusted to its care for PCB analysis for a period of two months after the results have been reported to USEPA OSC. Samples for other analyses shall be retained for a period of two weeks after reporting the results. Thereafter, the Testing Laboratory may return the samples to the Contractor for stockpiling for eventual disposal with the rest of the contaminated sediment. Other methods of sample disposal may be acceptable subject to the approval of USEPA OSC.

1) Instrument history.

2) Service record.

3) Routine Performance Test: This section includes a space for the date, initials of analyst, comments, and other instruments parameters if applicable.

I. Interferences: When interferences are suspected or indicated by other tests, the specific procedures for dealing with these interferences are described.

J. Precision and Accuracy: The statistical precision and accuracy results for the parameter generated by the Laboratory are to be documented.

K. Quality Control:

1) Internal Quality Control: In-house quality control standards, in addition to being controls, are to be used as a measure of precision under ideal conditions. Frequency of use is to be specified. Reagent blanks are to be determined to collectively check for possible contamination from the sample container, preservative, glassware, and laboratory reagents. Frequency of use is to be specified. The use of replicate analysis of real samples to measure precision is viewed as a product of the laboratories. This information is meant for use in interpreting analytical results and is of some use to the laboratory for evaluating the reported detection limits and catching possible interferences that might not be documented in the original method. The use of replicates is dependent on the parameter (the number of samples with positive values) and the analytical method. Frequency of use is to be specified. The use of real sample spikes (positive or negative) is also dependent on the convenience with which they fit into the analytical procedure. Spikes are useful for evaluating recovery in addition to precision. Frequency of use is to be described.

2) External Quality Control: Participation in various comparative analytical programs and frequencies outside of the laboratories are cited here.

3) Protocol for developing QA charts for precision and accuracy.

4) Protocol for developing field QA procedures should contain the following:

a. Field Sampling Techniques

b. Preservation and Holding Times

tocols. The language used to describe each method is to be detailed enough (cookbook fashion) so that a technician with experience in the respective type of analysis would clearly understand every step of the procedure. Analytical techniques that employ a great deal of instrumentation, such as atomic absorption and automated analyzers, are to be briefly described since instrument manuals are available which detail the use of the instrument. However, auto analyzer manifolds are to be depicted.

B. Modifications to submittals already transferred to USEPA OSC, including any changes in analytical procedures.

C. Instrument Parameters: A description of the instrument and all the instrument settings that are necessary to setup the instrument for normal conditions.

D. Routine Performance Tests: A test of the instrument performance which apart from calibration procedure is a gross indication of the instrument's responses. This test is performed and documented each time a batch of samples is processed on a daily basis. The frequency chosen for instrument response check is dependent on the analysts' confidence of instrument stability.

E. Calibration Standards: The calibration standards are described in terms of the range of concentrations used in the normal procedure and in terms of composition (preparation of standards solutions) employed for water and soil (sediment) samples.

F. In-House Quality Control Standards: (These are standards which are apart from calibration standards). Quality Control standards are meant to be a control procedure by which to judge whether the procedure is in-control or out-of-control after the various instrument checks have been satisfied. At least one quality control standard is determined with each batch of samples and the information is then documented.

1) One wheel of samples for auto analyzer technique.

2) A number of samples that is determined continuously without an interruption, such as a coffee or lunch break or a change or instrument settings - for atomic absorption techniques, manual techniques, and gas chromatographic techniques.

G. Data Calculations: The computations and manipulations that must be used to convert raw data to a final analytical result are described.

H. Instrument Log Book: The location of the instrument log book is stated. The instrument book is to contain, as a minimum, the following sections:

3.5 Testing Laboratory Quality Assurance Program:

3.5.1 General: The Testing Laboratory(s) must demonstrate to the USEPA OSC that it can implement a quality assurance (QA) program that will result in data of adequate quality to meet the Specifications. The quality assurance program applys to the chemical parameters listed in these Specifications and to any additional chemical parameters that the USEPA OSC may require. The quality assurance program does not apply to Soil Testing Services or Concrete Testing Services.

3.5.2 The Contractor shall be agreeable to an on-site evaluation of the Testing Laboratory to be used, if the USEPA OSC in consultation with the Owner's Quality Assurance Office deems such an evaluation appropriate.

3.5.3 Submittal Required with Proposal: The Contractor shall submit with his Proposal, the following QA information for each proposed Testing Laboratory:

I. A statement of policy concerning the Testing Laboratory's implementation of a (QA) program.

II. An organizational chart showing the position of the QA person(s) within the Testing Laboratory(s) organization.

III. A delineation of the responsibilities of the QA person(s) and the data quality responsibilities of the functional groups of the organization.

IV. A description of how the project will be handled. The description shall include how the Testing Laboratory(s) will interface with each other and the Contractor if more than one Testing Laboratory is used. The description shall include names of personnel who will collect the samples; how they will transport the samples to the Testing Laboratory; how the Testing Laboratory will handle samples requiring analysis completion and reporting within 24 hours; how samples will be stored; whether an on-site mobile laboratory will be used; the physical location of the Laboratory where each assay or analysis is made; and personnel responsible for reporting sample results.

V. How the laboratory will complete Quality Assurance Tests for PCB as described in Paragraph 3.2 of this Section.

VI. How the laboratory will implement the quality assurance requirements and sample custody is described in Paragraph 3.2 of this Section.

VII. Analytical Procedures:

A. A description of the analytical procedure for each parameter to include: a description of the normal analytical method used and the normal detection limits; and sample pretreatment and preparation pro-

UNIFIED SOIL CLASSIFICATION SYSTEM

COARSE-GRAINED SOILS

(More than half of material is larger than No. 200 seive size.)

GRAVELS More than half of coarse fraction larger than No. 4 sieve size

Clean Gravels (Little or no fines)

GW	Well-graded gravels, gravel-sand mixtures, little or no fines
GP	Poorly graded gravels, gravel-sand mixtures, little or no fines

Gravels with Fines (Appreciable amount of fines)

GM^{d}_{u}	Silty gravels, gravel-sand-silt mixtures
GC	Clayey gravels, gravel-sand-clay mixtures

SANDS More than half of coarse fraction smaller than No. 4 sieve size

Clean Sands (Little or no fines)

SW	Well-graded sands, gravelly sands, little or no fines
SP	Poorly graded sands, gravelly sands, little or no fines

Sands with Fines (Appreciable amount of fines)

SM^{d}_{u}	Silty sands, sand-silt mixtures
SC	Clayey sands, sand-clay mixtures

FINE-GRAINED SOILS

(More than half of material is smaller than No. 200 sieve.)

SILTS AND CLAYS Liquid limit less than 50%

ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
OL	Organic silts and organic silty clays of low plasticity

SILTS AND CLAYS Liquid limit greater than 50%

MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
CH	Inorganic clays of high plasticity, fat clays
OH	Organic clays of medium to high plasticity, organic silts

HIGHLY ORGANIC SOILS

PT	Peat and other highly organic soils

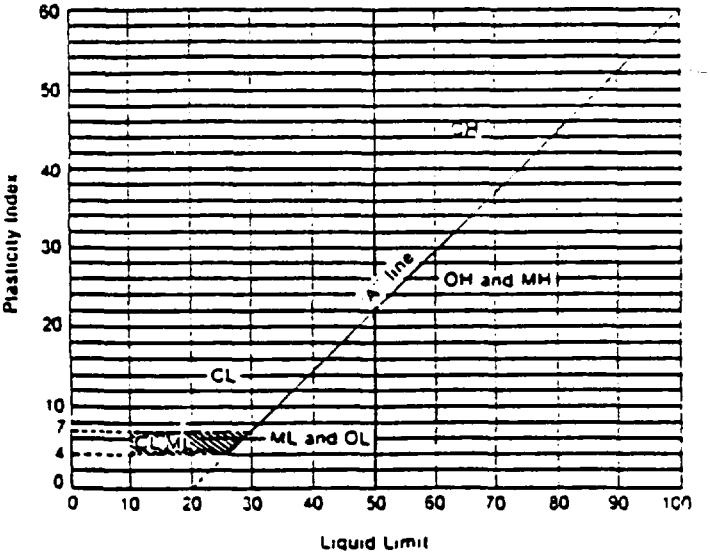
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for SW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 per cent	GW, GP, SW, SP
More than 12 per cent	GM, GC, SM, SC
5 to 12 per cent	Borderline cases requiring dual symbols

PLASTICITY CHART



For classification of fine-grained soils and fine fraction of coarse-grained soils.

Atterberg Limits plotting in hatched area are borderline classifications requiring use of dual symbols.

Equation of A-line: PI = 0.73 (LL - 20)

LOG OF TEST BORING

General Notes

Descriptive Soil Classification

GRAIN SIZE TERMINOLOGY

Soil Fraction	Particle Size	U.S. Standard Sieve Size
Boulders	Larger than 12"	Larger than 12"
Cobbles	3" to 12"	3" to 12"
Gravel: Coarse	¾" to 3"	¾" to 3"
Fine	4.78 mm to ¾"	#4 to ¾"
Sand: Coarse	2.00 mm to 4.78 mm	#10 to #4
Medium	0.42 mm to 2.00 mm	#40 to #10
Fine	0.074 mm to 0.42 mm	#200 to #40
Silt	0.005 mm to 0.074 mm	Smaller than #200
Clay	Smaller than 0.005 mm	Smaller than #200

Plasticity characteristics differentiate between silt and clay.

GENERAL TERMINOLOGY

Physical Characteristics
Color, moisture, grain shape, fineness, etc.

Major Constituents
Clay, silt, sand, gravel

Structure
Laminated, varved, fibrous, stratified, cemented, fissured, etc.

Geologic Origin
Glacial, alluvial, eolian, residual, etc.

RELATIVE DENSITY

Term	"N" Value
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

RELATIVE PROPORTIONS OF COHESIONLESS SOILS

Proportional Term	Defining Range By Percentage of Weight
Trace	0%- 5%
Little	5%-12%
Some	12%-35%
And	35%-50%

CONSISTENCY

Term	q_u-tons/sq. ft.
Very Soft	0.0 to 0.25
Soft	0.25 to 0.50
Medium	0.50 to 1.0
Stiff	1.0 to 2.0
Very Stiff	2.0 to 4.0
Hard	Over 4.0

ORGANIC CONTENT BY COMBUSTION METHOD

Soil Description	Loss on Ignition
Non Organic	Less than 4%
Organic Silt/Clay	4-12%
Sedimentary Peat	12-50%
Fibrous and Woody Peat	More than 50%

PLASTICITY

Term	Plastic Index
None to Slight	0-4
Slight	5-7
Medium	8-22
High to Very High	Over 22

The penetration resistance, N, is the summation of the number of blows required to effect two successive 6" penetrations of the 2" split-barrel sampler. The sampler is driven with a 140 lb. weight falling 30" and is seated to a depth of 6" before commencing the standard penetration test.

Symbols

DRILLING AND SAMPLING

CS—Continuous Sampling
RC—Rock Coring: Size AW, BW, NW, 2" W
RQD—Rock Quality Designator
RB—Rock Bit
FT—Fish Tail
DC—Drove Casing
C—Casing: Size 2½", NW, 4", HW
CW—Clear Water
DM—Drilling Mud
HSA—Hollow Stem Auger
FA—Flight Auger
HA—Hand Auger
COA—Clean-Out Auger
SS—2" Diameter Split-Barrel Sample
2ST—2" Diameter Thin-Walled Tube Sample
3ST—3" Diameter Thin-Walled Tube Sample
PT—3" Diameter Piston Tube Sample
AS—Auger Sample
WS—Wash Sample
PTS—Peat Sample
PS—Pitcher Sample
NR—No Recovery
S—Sounding
PMT—Borehole Pressuremeter Test
VS—Vane Shear Test
WPT—Water Pressure Test

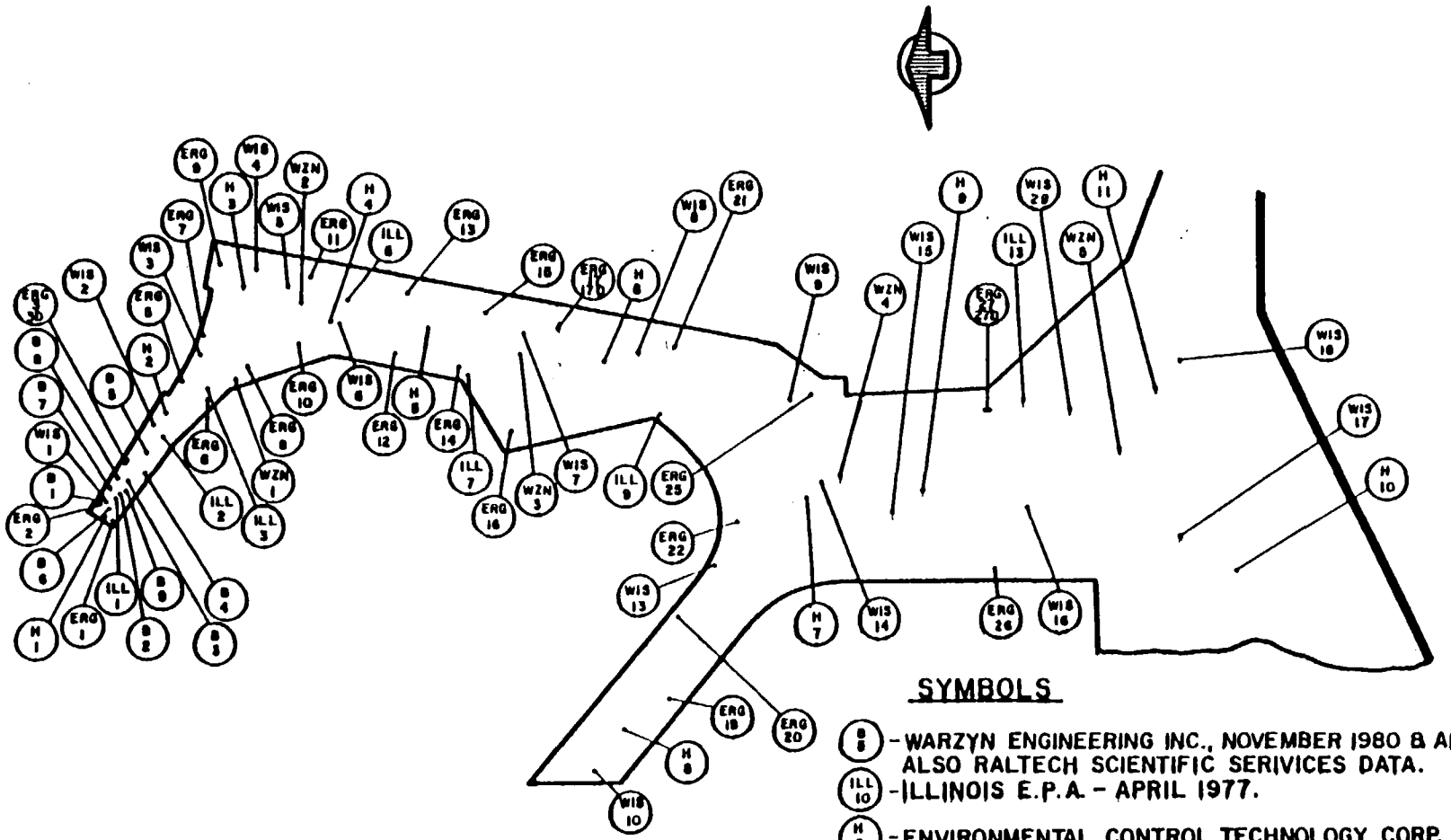
LABORATORY TESTS

q_p—Penetrometer Reading, tons/sq. ft.
q_u—Unconfined Strength, tons/sq. ft.
W—Moisture Content, %
LL—Liquid Limit, %
PL—Plastic Limit, %
SL—Shrinkage Limit, %
LI—Loss on Ignition, %
D—Dry Unit Weight, lbs./cu. ft.
pH—Measure of Soil Alkalinity or Acidity
FS—Free Swell, %

WATER LEVEL MEASUREMENT

▽—Water Level at time shown
NW—No Water Encountered
WD—While Drilling
BCR—Before Casing Removal
ACR—After Casing Removal
CW—Caved and Wet
CM—Caved and Moist

Note: Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils.


SYMBOLS
B 8 - WARZYN ENGINEERING INC., NOVEMBER 1980 & APRIL 1981 ALSO RALTECH SCIENTIFIC SERIVICES DATA.
ILL 10 - ILLINOIS E.P.A. - APRIL 1977.
H 8 - ENVIRONMENTAL CONTROL TECHNOLOGY CORP. (ENCOTEC), APRIL 1977.
ERG 25 - ENVIRONMENTAL RESEARCH GROUP INC., JUNE 1979.
WIS 10 - ARMSTRONG - UNIVERSITY OF WISCONSIN, JULY 1978.
WZN 6 - WARZYN ENGINEERING INC., JULY 1980.
TEST BORING OR SAMPLE LOCATIONS
(NO SCALE)

DIVISION 2 - SITEWORK

SECTION 02010
HARBOR BORINGS

1. GENERAL:

1.1 This Section contains data which describes the general character of soil materials to be encountered on the floor of Waukegan Harbor and data regarding the degree of polychlorinated biphenyl (PCB) contamination of the sampled soil materials.

1.2 The data presented was obtained during the period April 1977 through April 1981. Page 2 of this Section contains an outline of the Harbor showing approximate locations at which the test borings and samples were taken. Test boring and sample data presented herein has been keyed to the Harbor layout by use of the layout symbols.

1.3 Pages 3 through 27 pertain to test boring logs, grain size analysis and density tests as prepared by Warzyn Engineering, Inc., of Madison, Wisconsin. This data was obtained from the Harbor at points designated as "B".

1.4 Pages 17, 18, and 19 pertain to PCB Analysis of samples taken from the Warzyn test borings designated as "B". The PCB analyses were performed by Raltech Scientific Services, Inc., of Madison, Wisconsin.

1.5 The Contractor should note that during advancement of test boring logs at some points designated "B", a "crust" of sand was encountered atop the sediment on the Harbor floor. Removal of the sediment and measurement of the depth of the sediment may be affected by this localized "crust".

WARZYN
ENGINEERING INC

LOG OF TEST BORING

SAND Sample Collection

Project: Waukegan Harbor Slip #3
125'SE of NW End of Slip & 45'SW
Location: of Retaining Wall

Boring No. B3
Surface Elevation 2.22' below B.M.
Job No. C 9560
Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
Recovery			Moisture								
No.	Type	↓	↓	N	Depth		q_u	W	LL	PL	D
						WATER to 9.2'					
					10	Very Loose, Black, Organic Clayey SILT Trace Fine Sand (Muck) (OL)					
1	SS	11	W	10							
2	SS	13	W	27	15	Medium Dense, Gray Fine SAND, Trace Silt (SP)					
3	SS	15	W	32							
					20	End Boring at 18.5'					
						* Very Stiff, Gray, CLAY, Some Silt, Little Fine to Medium Sand, Trace Fine to Medium Gravel					
					25						
					30						
					35						
					40						

WATER LEVEL OBSERVATIONS

While Drilling
Upon Completion of Drilling
Time After Drilling
Depth to Water
Depth to Cave In

GENERAL NOTES

Start 11/21/80 Complete 11/21/80
Crew Chief WG Rig 55-2
Drilling Method CS 12.0' to 18.5'

WARZYN ENGINEERING INC

LOG OF TEST BORING

Project: SAND Sample Collection Waukegan Habor Slip #3

Location: 166'SE of NW End of Slip & 11'NW of Retaining Wall

Boring No. B4

Surface Elevation 2.55' below B.M

Job No. C 9560

Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE No.	Type	Recovery ↓	Moisture ↓	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES Qu	W	LL	PL	D
						WATER to 6.5'					
					5						
						Very Loose, Black, Organic Clayey SILT Trace Fine Sand (Muck) (OL)					
					10						
1	3"ST	15	W	-		Pushed Tube 10.5'-12.5', 15" Recovery of Medium Dense, Gray Fine SAND, Trace Silt (SP)					
2	3"ST	16	W	-		Pushed Tube 12.5'-14.5', 16" Recovery, Same As Sample 1					
3	SS	12	W	28	15	3" Lense of Coarse Sand & Fine Gravel @ 14.7', Pushed Tube 16.5'-18.0' (Refusal) 14" Recovery *					
4	3"ST	14	W	-							
5	SS	11	W	72							
6	SS	14	M	60	20	**					
						End Boring at 20.5'					
					25						
					30	* Gravel Lense at 18.5'					
					35	** Very Stiff, Gray, CLAY, Some Silt, Little Fine to Coarse Sand, Trace Fine to Medium Gravel					
					40						

WATER LEVEL OBSERVATIONS

While Drilling

Upon Completion of Drilling

Time After Drilling

Depth to Water

Depth to Cave In

GENERAL NOTES

Start 11/20/80 Complete 11/20/80

Crew Chief WG Rig 55-2

Drilling Method CS 10.5' to 20.5'

WARZYN ENGINEERING INC

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LOG OF TEST BORING

SAND Sample Collection

Project: Waukegan Harbor Slip #3

200'SE of NW End of Slip &

Location: 47'SW of Retaining Wall

Boring No. 85

Surface Elevation 2.42' below B.M.

Job No. C 9560

Sheet 1 of 1

SAMPLE No.	Type	Recovery	Moisture	N	Depth	VISUAL CLASSIFICATION and Remarks
					5	WATER to 9.2'
					10	*
1	3"ST	18	W	-		**
					15	End Boring at 11.7'
					20	* Very Loose, Black Organic SILT, Some Fine Sand (OL)
					25	** Pushed Tube 9.7' to 11.7', 18" Recovery of Medium Dense, Gray Fine SAND, Trace Silt, (SP)
					30	*** Gray Silty CLAY (Assumed)
					35	
					40	

SOIL PROPERTIES				
q_u	W	LL	PL	D

WATER LEVEL OBSERVATIONS

While Drilling

Upon Completion of Drilling

Time After Drilling

Depth to Water

Depth to Cave In

GENERAL NOTES

Start 11/19/80 Complete 11/19/80

Crew Chief WG Rig 55-2

Drilling Method CS 9.7' to 11.7'

SECTION 02010

WARZYN ENGINEERING INC

LOG OF TEST BORING

Project: SAND Sample Collection Waukegan Harbor Slip #3 35'SE of NW End of Slip & Location 39'SW of Retaining Wall

Boring No. B6A
Surface Elevation 2.25+ below B.M.
Job No. C 9560
Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE No.	Type	Recovery ↓	Moisture ↓	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES Qu	W	LL	PL	D
						WATER to 6.5'					
					5						
						Very Loose, Black Organic Clayey SILT Some Fine Sand (Muck) (OL)					
					10						
1	SS	13	W	16		*					
2	SS	13	W	22		Medium Dense, Gray Fine SAND, Trace Silt (SP)					
3	SS	15	W	39	15						
4	SS	16	W	31		Dense Gray, Fine SAND, Some Silt (SM)					
						**					
					20	End Boring at 19.0'					
						* Medium Dense, Black Fine SAND, Trace Silt (SP)					
					25	** Very Stiff, Gray Silty CLAY, Little Fine to Coarse Sand, Little Fine to Coarse Gravel					
					30						
					35						
					40						

WATER LEVEL OBSERVATIONS

While Drilling
Upon Completion of Drilling
Time After Drilling
Depth to Water
Depth to Cave In

GENERAL NOTES

Start 11/21/80 Complete 11/21/80
Crew Chief SL Rig 55-2
Drilling Method CS 10.6' to 19.0'

WARZYN ENGINEERING INC

LOG OF TEST BORING

OMC

Project: Waukegan Harbor Slip #3
80'SE & 7.5'SW of North
Location: Corner of Slip #3

Boring No. R7
Surface Elevation 579.12
Job No. C 9729
Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE No.	Type	Recovery	Moisture	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES Qu	W	LL	PL	D
						WATER to 10.4'					
					10	Black MUCK (OL)					
1	SS	X	W	43	15	Dense, Gray, Fine to Medium SAND, Some Silt Trace Fine to Coarse Gravel (SP-SM) Very Oily at 18-18.5'					
2	SS	X	M	37	20	Very Stiff, Gray, Silty CLAY, Little Fine to Coarse Sand, Trace Fine to Coarse Gravel (CL) Oily to 19.5'					
3	SS	X	M	21							
4	SS	X	M	83							
5	SS	X	M	110							
						Very Dense, Gray SILT, Little Fine Sand (ML) Not Oily					
					25	Borehole Backfilled with Bentonite					
						End Boring at 24.5'					
					30						
					35						
					40						

WATER LEVEL OBSERVATIONS

While Drilling
Upon Completion of Drilling
Time After Drilling
Depth to Water
Depth to Cave In

GENERAL NOTES

Start 3/16/81 Complete 3/16/81
Crew Chief JR Rig CME 550
Drilling Method 4" Casing to 20.5'; Rotary Wash Bore & Split Spoon

WARZYN ENGINEERING INC

LOG OF TEST BORING

OMC

Project: Waukegan Harbor Slip #3
122'SE & 5'SW of North
Location: Corner of Slip #3

Boring No. B8
Surface Elevation 578.92
Job No. C 9729
Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE No.	Type	Recovery	Moisture	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu	W	LL	PL	D
						WATER to 10.9'					
						Very Loose, Black MUCK (OL)					
1	SS	X	W	19		Medium Dense, Gray Fine to Coarse SAND, Little Silt, Little Fine to Coarse Gravel Slightly Oily (SW-SM)					
2	SS	X	W/M	39	20						
3	SS	X	M	29		Very Stiff, Gray Silty CLAY, Little Fine to Coarse Sand, Trace Fine to Coarse Gravel Not Oily (CL)					
4	SS	X	M	85	25	Not Oily at Bottom of Boring					
						Borehole Backfilled with Bentonite End Boring at 27.5'					
					30						
					35						
					40						

WATER LEVEL OBSERVATIONS

While Drilling
Upon Completion of Drilling
Time After Drilling
Depth to Water
Depth to Cave In

GENERAL NOTES

Start 3/19/81 Complete 3/19/81
Crew Chief JR Rig CME 550
Drilling Method 4" Casing to 21.5'; Rotary Wash Bore & Split Spoon

WARZYN ENGINEERING INC

LOG OF TEST BORING

OMC

Project: Waukegan Harbor Slip #3
105'SE & 59'SW of North
Location: Corner of Slip #3

Boring No. B9
Surface Elevation 578.92
Job No. C 9729
Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
Recovery			Moisture				q_u	W	LL	PL	D
No.	Type	↓	↓	N	Depth						
						WATER to 5.7'					
					5						
						*					
1	SS	0	-	0		Very Loose, Gray & Black Fine to Medium SAND, Some Silt, Some Organics (Stratified Muck & Sand) Not Oily (SP-SM/OL)					
					10	Split Spoon Settled from 6.1-9.1'					
2	SS	X	W	1		Under Weight of Hammer-No Blows					
					15						
3	SS	X	W	7		Loose, Gray Fine to Medium SAND, SomeSilt, Not Oily (SM)					
4	SS	X	M	79	20	Very Stiff, Gray Silty CLAY, Little Fine to Coarse Sand, Little Fine to Coarse Gravel Not Oily (CL)					
5	SS	X	M	80		4" Lense of Fine to Coarse Sand at 19.8-20.1'					
6	SS	X	M	63	25	Not Oily At Bottom of Boring Borehole Backfilled with Bentonite End Boring at 24.5'					
					30	* Black, Fine to Coarse SAND, Little Fine to Coarse Gravel, Little Silt (SW-SM)					
					35						
					40						

WATER LEVEL OBSERVATIONS

While Drilling
Upon Completion of Drilling
Time After Drilling
Depth to Water
Depth to Cave In

GENERAL NOTES

Start 3/18/81 Complete 3/18/81
Crew Chief JR Rig CME 550
Drilling Method 4" Casing to 20.5'; Rotary Wash Bore & Split Spoon

WARZYN ENGINEERING INC

LOG OF TEST BORING

OMC

Project: Waukegan Harbor Slip #3
35'SE & 7.5'NE of North
Location: Corner of Slip #3

Boring No. B10
Surface Elevation 95.68
Job No. C 9729
Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
Recovery			Moisture								
No.	Type	↓	↓	N	Depth		q_u	W	LL	PL	D
						*					
1	SS	X	W	16		Medium Dense, Black, Medium to Coarse GRAVEL, Some Sand, Little Silt (FILL-Crushed Stone) Not Oily (GP-GM)					
					5						
						Very Loose, Gray, Fine to Medium SAND, Little Silt, Little Fine to Coarse Gravel, Not Oily, Lense of Coarse Sand & Fine Gravel at 12.8' to 13.0' (SP-SM)					
2	SS	X	W	2	10						
					15						
						Wash Water Turned Oily at 19.5'					
3	SS	X	W/M	37	20	Very Stiff, Gray, Silty CLAY, Little Fine to Coarse Sand, Little Fine to Coarse Gravel, Not Oily (CL)					
4	SS	X	M	63	25	Not Oily at Bottom of Boring					
						Borehole Backfilled with Bentonite End Boring at 25.9'					
					30						
						* Brown Fine to Coarse Sandy GRAVEL, Some Silt (Roadbed) (SW-SM)					
					35						
					40						

WATER LEVEL OBSERVATIONS

While Drilling
Upon Completion of Drilling
Time After Drilling
Depth to Water
Depth to Cave In

GENERAL NOTES

Start 3/24/81 Complete 3/24/81
Crew Chief JR Rig CME 550
Drilling Method 4" Casing to 21.5'; Rotary Wash Bore & Split Spoon

WARZYN ENGINEERING INC

LOG OF TEST BORING

OMC

Project: Waukegan Harbor Slip #3
65'SE & 23'NE of North
Location: Corner of Slip #3

Boring No. B11
Surface Elevation 95.87
Job No. C 9729
Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9536, MADISON, WIS. 53715 • TEL. (608) 257-4848

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
Recovery			Moisture				q_u	W	LL	PL	D
No.	Type	↓	↓	N	Depth						
						*					
						Loose, Black, Fine to Coarse SAND, Little Silt, Trace Fine to Coarse Gravel, Not Oily (SP)					
1	SS	X	W	7	5						
					10	Medium Dense, Gray, Fine to Coarse SAND, Little Silt, Trace Fine to Medium Gravel, Trace Organics, Not Oily, Lense of Black Organic Silt at 14.9-15.1' (SP)					
2	SS	X	W	25	15						
3	SS	X	W	13		Wash Water Turned Oily @ 16.0-18.0' Lenses of Coarse Sand & Fine Gravel @ 16.5-16.6', 19.4-19.6' & 20.1-20.3', Not Oily					
4	SS	X	W	11	20						
5	SS	X	M	61		Very Stiff, Gray, Silty CLAY, Little Fine to Coarse Sand, Little Fine to Coarse Gravel Not Oily (CL)					
6	SS	X	M	59	25	Not Oily at Bottom of Boring					
						Borehole Backfilled with Bentonite					
						End Boring at 26.4'					
					30						
						* Brown, Fine to Coarse Sandy GRAVEL, Some Silt (FILL) (GW-GM)					
					35						
					40						

WATER LEVEL OBSERVATIONS

While Drilling
Upon Completion of Drilling
Time After Drilling
Depth to Water
Depth to Cave In

GENERAL NOTES

Start 3/23/81 Complete 3/23/81
Crew Chief JR Rig CME 550
Drilling Method 4" Casing to 22.5'; Rotary Wash Bore & Split Spoon

WARZYN ENGINEERING INC

LOG OF TEST BORING

OMC

Project: Waukegan Harbor Slip #3
75'SE & 10'NE of North
Location: Corner of Slip #3

Boring No. B12
Surface Elevation 95.79
Job No. C 9729
Sheet 1 of 1

1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

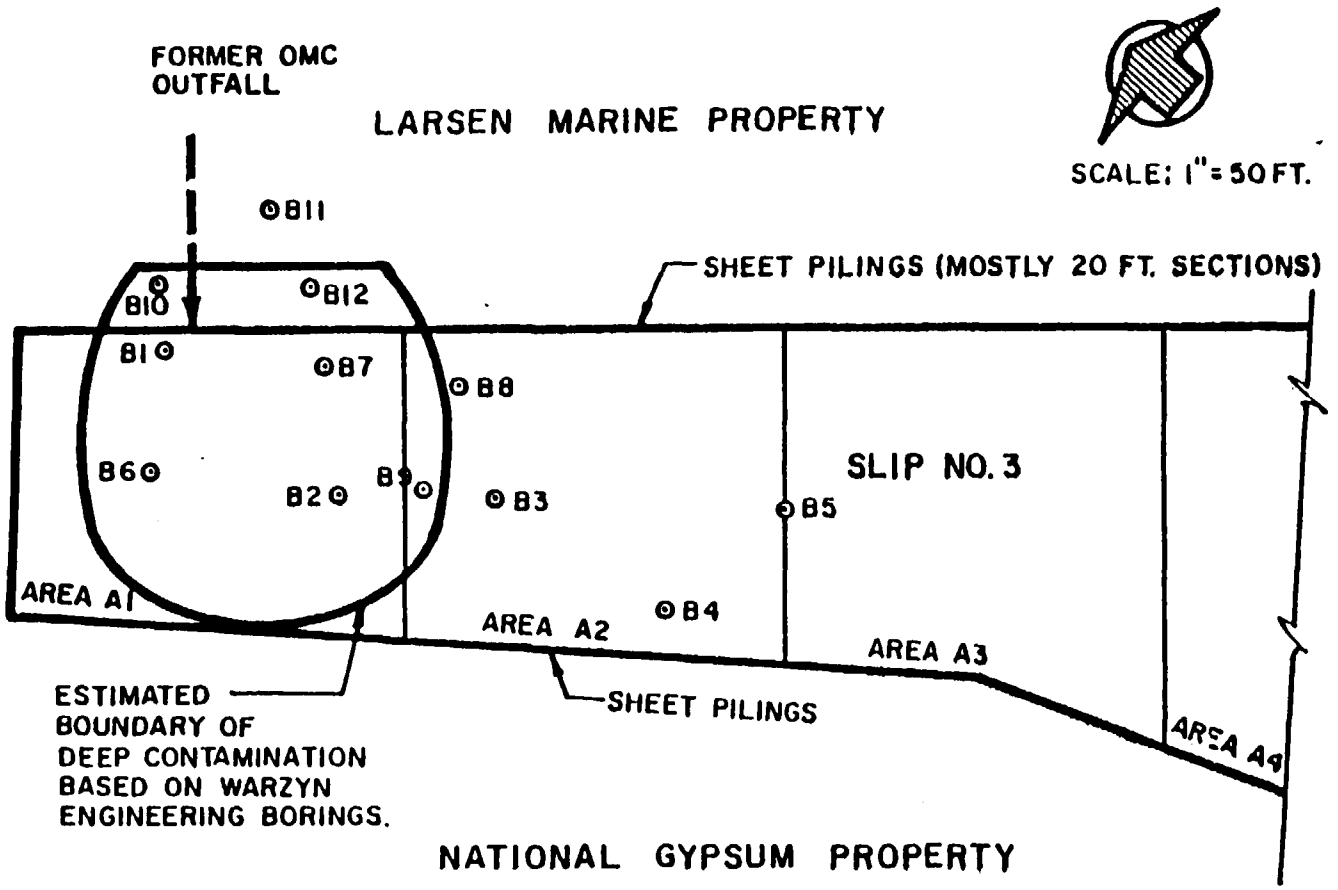
SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
Recovery			Moisture								
No.	Type	↓	↓	N	Depth		q_u	W	LL	PL	D
						Brown, Fine to Coarse Gravelly SAND (FILL) (SW)					
1	SS	X	W	7							
						Loose, Black, Medium to Coarse GRAVEL, Some Silt, Little Sand (Crushed Stone Fill) Not Oily (GP-GM)					
					5						
						Gray, Fine to Medium SAND, Little Silt (SP-SM)					
					10						
						Wash Water Turned Black, Assumed Organic SILT Lense, Not Oily (OL)					
2	SS	X	W	9		Drove a Piece of Wood; Not Oily But Chemical Odor (PT)					
					15						
3	SS	X	W	5		Very Loose, Gray, Fine to Medium SAND, Trace Silt, Trace Organics, Lense of Coarse Sand & Fine Gravel at 15.7-15.9 Not					
					20	* Oily (SP-SM)					
4	SS	X	W/M	30		Very Stiff, Gray, Silty CLAY, Little Fine to Coarse Sand, Trace Fine to Coarse Gravel, Very Oily (CL)					
5	SS	X	M	39	25	Not Oily at Bottom of Boring					
						Borehole Backfilled with Bentonite					
						End Boring at 25.4'					
					30						
						* Wash Water Turned Oily at 20.0'					
					35						
					40						

WATER LEVEL OBSERVATIONS

While Drilling
Upon Completion of Drilling
Time After Drilling
Depth to Water
Depth to Cave In

GENERAL NOTES

Start 3/24/81 Complete 3/24/81
Crew Chief JR Rig CME 550
Drilling Method 4" Casing to 21.5'; Rotary Wash Bore & Split Spoon



● BORINGS B1 THRU B6 NOVEMBER 19 - 22, 1980.
● BORINGS B7 THRU B12 MARCH 16 - 20, 1981.

NOTE:
PCB ANALYSES PRESENTED IN FIGURES 2 AND 3.

FIGURE 1
LOCATION OF CORE BORINGS IN NORTHWEST END OF SLIP NO. 3

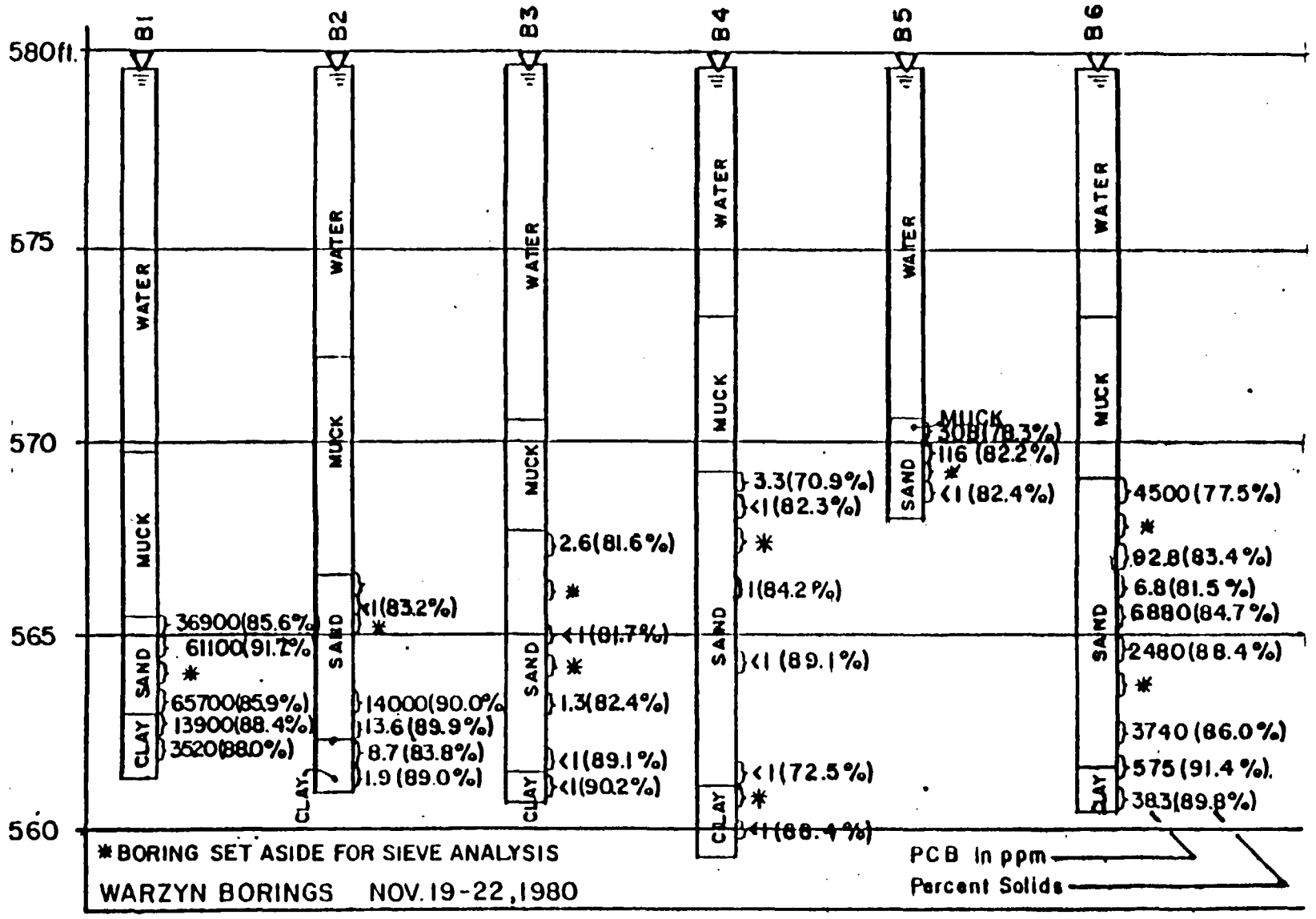


FIGURE 2

PCB ANALYSIS OF SLIP NO. 3 CORE BORINGS B1 – B6

DIVISION 16 - ELECTRICAL

SECTION 16155
MOTOR CONTROLS

1. GENERAL:

1.1 This Section covers acceptable materials and methods of installation of manual and magnetic starters, combination starters and control devices.

1.2 Equipment provided under this Section shall be listed and/or labeled by the Underwriters' Laboratories, Inc., and the equipment shall bear the UL seal.

1.3 Refer to the Drawings for equipment locations, ratings and for required motor control devices, accessories, etc.

2. MATERIALS:

2.1 Manual Motor Starters - All manual starters shall consist of manually operated switches, 1-, 2-, or 3-pole, as shown on the Drawings. Except as indicated otherwise, manual starters shall be non-reversing type. These starters shall be equipped with thermal overload devices designed and manufactured as specified hereinbelow. Heater elements shall be one-piece construction, shall be interchangeable and the starter shall be inoperative if the thermal unit is removed.

2.1.1 Where indicated, manual starters shall be key operated and a compatible key shall be provided with each of these type operators.

2.1.2 Manual starter enclosures shall have the NEMA classification as indicated and shall have provisions for locking in the "OFF" positions.

2.1.3 Manual starters shall have a pilot light located on the front cover.

2.1.4 Manual starters shall be Square D Class 2510, Allen-Bradley Bulletin 600, Cutter-Hammer type 9101 or 9115, or equal.

2.2 Magnetic Starters and Contactors - All magnetic starters and contactors shall be steel mounted, front wired with all terminals accessible for wiring directly from the front. Movable contact blocks shall depend on gravity only and not the use of springs for operation to the open position.

2.2.1 Starter and contactor NEMA standard sizes and other ratings shall be as indicated. In no case shall any starter or contactor be smaller than NEMA size 0.

2.2.2 All contacts shall be double break, solid silver cadmium oxide alloy, or equal. Bare copper or silver flashed copper contacts which require periodic filing or cleaning maintenance will not be permitted.

2.2.3 Operating coils shall be pressure molded and so designed that, if accidently connected to excessive voltage they will not expand, bubble or melt. When a coil fails under any condition, the starter shall open and shall not "freeze" in the closed (on) position. Coils shall be rated at 120 volts and shall be replaceable from the front of the starter without having to remove the starter from the panel or enclosure.

2.3 Overload Relays: Overload relays shall be installed in all ungrounded motor feeder lines.

2.3.1 Overload relays shall be eutectic type, manually resetable. Operation shall be trip-free in that blocking the reset mechanism in the reset position will not prevent the operation of the relay if the motor is overloaded. Depressing the reset button or mechanism shall not open the starter contacts.

2.3.2 All starters shall be equipped with an indicator, visible at the front of the starter, which indicates when the motor served by the starter has overloaded to the point that the starter has opened due to the action of the overload relays.

2.3.3 Thermal units shall be of one piece construction and interchangeable within the range of the starter unit. The starter shall be inoperative if the thermal unit is not in place.

2.3.4 All overload relays shall be sized from actual motor nameplate data taking into account the temperature ratings, starting characteristics, and current ratings of the particular motor it is protecting.

2.3.4.1 Temperature ratings of the motors in relation to the overload relay ratings will be affected by the ambient temperature at the motor location in relation to the ambient temperature at the starter. These relationships shall be taken into account when sizing the overload relay thermal units following the recommendations of the particular starter manufacturer. In no case shall the relay and its thermal unit be sized higher than the percentage values given in Article 430-C of the National Electrical Code.

2.3.5 The scope of this Work includes the eventual replacement of several pumps with pumps of a substantially smaller sized motor. Overload relay blocks shall be arranged such that an entire range of thermal units may be installed in the same block without changing the block. If a starter is provided that employs an overload relay block which will accept thermal units only within a limited range, the block shall be a separate device which can be exchanged in the future for a smaller unit without having to change the starter contactor.

2.4 Control Circuitry: Control circuitry voltage shall be 120 volts and all control devices shall be rated to operate at this voltage. Certain control devices may be indicated to be provided under other Divisions of the Specifications and wired under this Section. The Contractor shall verify that all devices falling into this catagory are rated for the specified control voltage.

2.4.1 Pushbutton controls shall be non-illuminated, momentary contact (unless otherwise shown in the schematics), oil tight, fully guarded equal to Square D, Class 9001, Type "K". Pushbuttons shall have a means of installing a metal plate to designate the function.

2.4.2 Selector switch operators shall be non-illuminated, oil tight, number of positions as shown in the schematics, for use with maintained contact or momentary contact as shown, equal to Square D, Class 9001, Type "K". Momentary contact type shall be spring-return-to "off" position. Where Hand-Off-Automatic switches are shown on the Drawings controlling a control circuit of a magnetic starter, connections to the selector switch shall be such that only the normal automatic regulatory control devices will be bypassed when the switch is in the "Hand" position; all safety control devices such as low-or-high-pressure cutouts, high-temperature cutouts, low-or-high level cutouts, and motor overload protective devices, shall be connected in the starter control circuit in both the "Hand" and "Automatic" positions of the selector switch.

2.4.3 Contact blocks shall be gangable, reversible, completely compatible with the necessary operator, double-break silver contacts with a flexible, movable contact blade providing a scrubbing action with positive wipe. Contacts shall be rated at the indicated control voltage, 10 amperes continuous, and shall be equal to Square D Class 9001, Type K. Where multi-station control points are indicated, terminals shall be provided in the starter to connect the control stations located remote from the starter using one wire per terminal.

2.4.4 Pilot lights shall be rated at the indicated control voltage, press-to-test, incandescent, with the lens color as shown on the schematics, and shall be wired such that if the starter is open for any reason, the pilot light will be extinguished. Terminals shall be provided for connection of remote pilot lights. Pilot lights which are low voltage rated and utilize an integral transformer to obtain the proper voltage shall not be acceptable.

2.4.5 Control voltage shall be obtained by use of a control circuit transformer and each starter unit shall contain its own control circuit transformer. The transformer primary shall be connected across two phases of the main power line feeding the starter which is obtaining the control voltage from the transformer installed. Opening the starter disconnect shall remove power from the control circuit transformer. The control circuit transformers and their associated over-current protection shall be sized to include the loads, including any inrush, of all control and indicating devices which will present a load to the circuit it feeds.

2.4.6 Auxiliary control relays shall be rated for continuous duty, and shall be magnetic, heavy duty, industrial or machine tool type with fine silver, double-break contacts rated at 5 amperes, 600 volts. Unless otherwise shown on the Drawings, coils shall be of molded construction and shall be rated to operate at the indicated control voltage. Terminals shall be mechanical type, pressure wire connectors. Relays shall be equal to Square D, Class 8501, Type C in an enclosure NEMA rated as shown on the Drawings.

2.4.7 Remote Control Station: Enclosure located in the Operations Building for remotely mounted controls shall be surface-mounted type, with cover retained by machine screws. Mounting holes for control devices shall be factory cut. Enclosure shall be NEMA 1. A machine engraved, laminated plastic, nameplate shall be secured to the enclosure denoting the equipment controlled in addition to the metal legend plate denoting the function of the individual controls.

2.4.8 Legend Plates: Legend plates shall be of the metal ring type which installs around the control device under the ring unit. Lettering shall be factory finished to denote the function of each control device. Where protective caps are used, legend plates shall be rectangular, separately mounted, factory finish type.

2.5 Controller Disconnects: The controller disconnects shall be fusible, quick-make, quick-break, switches. Disconnect sizes and fuse type and size shall be as indicated. Fuse clips shall be of the type capable of accepting fuse reducers for future operation of smaller pumps using the same control equipment.

2.6 Separately Enclosed Combination Starters: All separately mounted combination starters shall be as manufactured in accordance with the latest published NEMA standards. Combination starters shall consist of fusible switch, motor starter, overload relays, control circuit transformer, control relays, and other control devices. Equipment shall be as specified hereinbefore. Enclosures shall be the NEMA type as indicated.

2.6.1 A flange-mounted operator shall be permanently attached to the switch operator with positive indication of position with the unit door either open or closed. The operator shall have provisions for padlocking with the overcurrent device in the "open" (off) position and in the "closed" (on) position.

2.6.2 The door latch shall be tamper-proof with a coin-proof slot in the door handle latch. The door shall be lockable in the closed position and shall have double safety interlocking on the operator and the door handle to prevent opening of the door when the operator is in the "ON" position as well as to prevent placing the operator in the "ON" position if the door is open. Both interlocks shall be defeatable by authorized personnel using a tool.

2.6.3 The starter reset operator and, where such devices are indicated, pilot lights, pushbuttons, selector switches, etc. shall be mounted on the front of the unit.

2.7 Transformer/Relay Unit: The transformer/relay unit shown in the Operations Building controlling the polymer feeder equipment shall consist of a transformer with fused secondary, relay and hand-off-automatic switch all enclosed in a single NEMA 1 enclosure and wired as shown on the Drawings.

2.7.1 The transformer shall be equal to Square D Class 9070, type EO-91, 2000 VA, 240/480 -120 volts with Class 9080, type PF-1 fuse block separately mounted and connected in the secondary circuit. Fuse as shown on the Drawings.

2.7.2 A fuse block equal to Square D Class 9070, type AP-1 shall be separately mounted and wired to protect the control circuit. Fuse as shown on the Drawings.

2.7.3 The control relay shall be equal to Square D, Class 8501, type CO-1 with one (1) normally open contact.

2.7.4 Terminal blocks shall be installed for input and output circuits. Terminal blocks shall be equal to Square D, Class 9080, Type G, 600 volt with mounting channel as required.

2.7.5 The enclosure shall be equal to Hoffman "Instrument Enclosure", hinged door, steel back panel, sized as required to contain the equipment specified in this article. Mount the hand-off-automatic switch in the enclosure door.

3. EXECUTION:

3.1 Overload and Overcurrent Devices:

3.1.1 EACH SET OF OVERCURRENT AND OVERLOAD PROTECTIVE DEVICES SHALL BE PROVIDED TO CORRESPOND TO THE ACTUAL MOTOR NAMEPLATE DATA. BEFORE MOTORS ARE ENERGIZED, THE CONTRACTOR SHALL SUBMIT TO THE USEPA OSC, TWO COPIES OF A LISTING OF EACH MOTOR, MOTOR NAMEPLATE DATA (VOLTAGE/PHASE/HERTZ/FULL LOAD AMPERES/LOCKED ROTOR AMPERES/MOTOR CODE LETTER/SERVICE FACTOR), AND PROPOSED MOTOR OVERLOAD DEVICE(S) WITH TRIP SETTING(S).

3.2 Control Wiring:

3.2.1 Conductors shall be copper, solid or stranded, sized as necessary for load and voltage drop requirements except that no control wire shall be smaller than AWG No. 14. Insulation shall be THW or THWN.

3.2.2 All internal wiring to terminal blocks shall be identified by color coding and numbered wire markers.

3.2.3 All wiring extended from control points to other control and indicator points shall be grouped according to the motor controlled (Lagoon South Pump, Sedimentation Pump #1, etc.) when pulled to control panel, junction boxes, etc. Particular attention shall be paid to the color coding and numbering scheme. For instance, if a red insulated conductor numbered "3" originates at a particular motor, it shall be red and numbered "3" in any junction box, terminal point, cabinet, etc. where it is visible by removing a cover or opening a unit door. NO TWO WIRES IN THE SAME COMPARTMENT THAT ARE THE SAME COLOR SHALL ALSO HAVE THE SAME NUMBER.

4. SPARE PARTS:

4.1 The Contractor shall furnish the following spare parts:

4.1.1 Three fuses of each size provided.

4.1.2 Twelve lamps for indicating lights.

4.2 All items shall be packaged in suitable containers bearing labels clearly indicating the contents and equipment with which they are to be used.

4.3 Spare parts shall be delivered at the same time as the equipment to which they pertain. The Contractor shall not use the parts delivered as "spare parts" to replace parts found defective or those that may be damaged during construction. The Contractor shall properly store and safeguard such spare parts until needed for operational use. Two (2) copies of a spare parts inventory shall be furnished the USEPA OSC.

5. TESTING:

5.1 Refer to Section 16999: ELECTRICAL FIELD ACCEPTANCE TESTS for testing procedures.

In accordance with the requirements of the General Conditions and Supplementary General Conditions, the following information is required of the Contractor.

ITEM OR DESCRIPTION	SHOP DRAWINGS	CATALOG DATA	PARTS LIST	OPERATING MANUAL	WIRING DIAGRAM	CERTIFICATION	SAMPLES	OTHER
Manual Motor Starters		X	X					
Magnetic Starters		X	X		X			
Overload Relays	X	X	X			X		
Pushbutton Controls		X	X		X			
Selector Switches		X	X		X			
Pilot Lights		X	X		X			
Control Transformers		X			X			
Control Relays		X	X		X			
Remote Control Station	X	X	X	X	X			
Combination Starters	X	X	X	X	X			
Transformer/Relay Unit	X	X	X	X	X			
Spare Parts			X					

SECTION 16160
DISTRIBUTION EQUIPMENT
(600 VOLTS AND BELOW)

1. GENERAL:

This Section covers materials and installation procedures for the main switchgear, fuses, safety switches and other items related to power distribution equipment.

2. MATERIALS:

2.1 Power Distribution Panel:

2.1.1 Power distribution panel shall be equal to Square D "I-Line" type and shall be dead front safety type, equipped with thermal/magnetic molded case circuit breakers with trip ratings and accessories such as undervoltage release, shunt trip, manual trip, field adjustable magnetic trip, etc. as listed in the schedules or shown on the Drawings.

2.1.2 Panel bus structure shall have current ratings as shown on the Drawings. The panelboard shall be located as shown on the Drawings. Current ratings of the main panelboard bussing shall have been determined by heat rise tests with a maximum hot spot temperature on any bus bar not to exceed 50 degrees C. rise above ambient. The use of bus bar dimensions will not be accepted in lieu of actual heat tests. Panelboard bus structure shall run the full length for future installation of additional circuit breakers.

2.1.3 A separate ground bar shall be included. Lugs in or on this bar shall vary in size and shall be sized to accept the grounding conductors from each of the various sized circuits originating in the panel. The ground bus shall be bonded to the panel enclosure. Sufficient lugs shall be provided such that not more than one conductor shall be installed under one lug.

2.1.4 Circuit breakers shall be equipped with individually insulated, braced and protected connectors. The front face of all circuit breakers shall be flush with each other. Tripped indication shall be clearly shown on the breaker handle taking a position between "ON" and "OFF". Provisions for additional breakers shall be such that no additional connectors will be required to add breakers. Multipole breakers shall have a single handle operator. No handle ties or other means which tie the handles of single pole breakers together to make a multi-pole breaker will be acceptable.

2.1.5 Any device indicated on the Drawings or in the schedule which locks the breaker on or off shall in no way hinder the tripping mechanism of the breaker. The interior assembly shall be dead front with the front removed. Also, it shall be possible to change branch circuit load connections without exposure of personnel to any line side bussing or line terminals. The barrier

in front of the connection to the main bussing shall have provisions for swinging it out of the way for inspections and maintenance. The end of the bus structure opposite the mains shall be barriered.

2.1.6 Front shall be non-tamperable complete with door and flush chrome plated pin type cylinder lock and catch. Furnish the USEPA OSC with six (6) keys.

2.1.7 A directory frame with transparent cover shall be furnished and installed on the inside of the door of the panelboard. The directories shall be typewritten and shall indicate the location and purpose of the outlets and equipment supplied by each circuit.

2.1.8 The panelboard shall be listed by Underwriters' Laboratories and shall bear their label.

2.1.9 The panelboard schedule is near the end of this Section of the specifications.

2.1.10 Panelboard as manufactured by Cutler-Hammer, Westinghouse, or approved equal will be acceptable so long as it meets the above specifications.

2.2 Safety Switches:

2.2.1 All safety switches shall be heavy-duty load break type with a quick-make, quick-break, switch mechanism. The switches shall be fused or unfused as indicated on the Drawings. The handle position shall give visual indication of open and closed switch position. Padlocking capability shall be provided for locking the switch in the off position.

2.2.2 The switch jaws shall be multi-spring type for positive grip of the switch blades and shall be provided with arc suppressors. The fuse clips shall be spring reinforced, positive pressure type of electrolytic copper.

2.2.3 The switch shall be provided with cover-blade interlock so that the cover cannot be opened when the switch blades are closed, nor can the switch blades be closed with the cover open. Interlock bypassing devices shall be included for use by authorized personnel.

2.2.4 Enclosures shall be NEMA 1 where used inside the building and NEMA 3R where used outside unless otherwise shown on the Drawings.

2.2.5 Switches shall be Square D, Westinghouse, ITE or equal.

2.3 Fuses:

2.3.1 The Contractor shall provide fuses as called for on the Drawings. Where the fuse size is not indicated the Contractor shall size the

fuse for actual load installed. Where the fuse size is indicated on the Drawings the Contractor shall verify the actual load installed and provide fusing accordingly.

2.3.2 All fuses shall be non-renewable, current limiting, dual element, time-lag type. The fuses shall have an interrupting capacity of at least 100,000 amperes RMS symmetrical. The basic fuse time current interrupting characteristics shall be as follows:

500 percent load	10 sec. interrupting time
400 percent load	19 sec. interrupting time
300 percent load	39 sec. interrupting time
200 percent load	110 sec. interrupting time

2.3.3 Unless otherwise shown on the Drawings or specified in any Section of these Specifications, TEN PERCENT (10%) SPARE FUSES OF ALL TYPES AND RATINGS SHALL BE PROVIDED, BUT NOT LESS THAN THREE (3) OF ANY ONE RATING AND NOT MORE THAN NINE (9) OF ANY ONE SIZE. Spare fuses shall be packaged as to size and the equipment which the packaged fuses of that particular size fit listed on the outside of the package. The Contractor shall properly store and safeguard the spare fuses until needed for operational use. Two (2) copies of a fuse inventory list shall be furnished the USEPA OSC.

2.3.4 Fuse clips shall be identified as to what size fuse is required in the particular switch as given in the Contract Documents. "Stick-on" identification will not be acceptable. Permanent markers such as plastic nameplates shall be used. These plates may be installed between fuse clips. This requirement applies to starter disconnect switches as well as other switches.

2.4 Lightning Protection Equipment:

2.4.1 The secondary service shall be fitted with secondary surge arresters. Secondary voltages are considered anything below 600V.

2.4.2 Arresters shall be equal to Joslyn Catalog J9200-7A rated at 650 V, valve type. Three are required, one between each phase and ground.

2.4.3 Ground connections shall be made to ground rods separately from the equipment grounds, however, the rods shall be connected to the rods of the building equipment grounding system. Ground rods and connecting wiring shall be as shown in the Drawings.

2.5 Transformers:

2.5.1 The transformers used to feed the turbidity monitoring equipment shall be outdoor type, free standing or support-mounting, single phase, 480V-120V, 2 KVA (minimum).

2.5.2 These transformers shall be mounted and wired as shown on the drawings.

3. EXECUTION:

3.1 Installation of equipment specified in this Section shall be where shown on the Drawings. Where no details are shown concerning mounting or other installation methods, equipment shall be installed as per manufacturer's recommendations or as specified hereinafter.

3.2 Power panel as well as safety switches shall be mounted directly to walls where shown on the Drawings. Mounting shall be in such a manner that no pressure of weight is placed on any conduit entering the enclosures. Where no walls are near the locations where safety switches are shown, bracket mounting on steel channels such as those manufactured by Unistrut, Kindorff or equal will be required. Details are shown on the Drawings.

3.3 Lightning surge arresters shall be mounted where as shown on the drawings and as recommended by the manufacturer and at locations shown on the Drawings.

3.4 Where lugs are provided for installation of wire such as terminal strips, ground bars, circuit breakers, neutral bars, or separately mounted lugs, not more than one conductor shall be installed under one lug.

3.5 Circuit designations shall be TYPED on circuit directory cards.

4. TESTING:

4.1 Refer to Section 16999: ELECTRICAL FIELD ACCEPTANCE TESTS for testing procedures.

PANELBOARD MAIN MOUNTING SURFACE

VOLTAGE 480Y/277 PHASE 3 WIRE 4 GROUND YES MAIN 600A MAIN CKT. BKR. 500A

POLE NO.	CKT. NO.	CKT. BKR. TRIP/POLE		SERVES	LOAD KVA	ØA	ØB	ØC	KVA	SERVES	CKT. BKR. TRIP/POLE		CKT. NO.	POLE NO.
1														2
3	1	150	3	LAGOON PUMP CIRCUITS						SEDIMENTATION BASIN & S. SUMPS	250	3	2	4
5														6
7														8
9	3	20	3	EQUIPMENT PAD SUMP PUMPS						CLEARWELL PUMPS	175	3	4	10
11														12
13														14
15	5	30	3	TREATMENT EQUIPMENT						OPERATIONS BLDG - RECEPTACLE	16	2	6	16
17										SITE LIGHTING - SOUTH	15	1	8	18
19	7	15	1	SITE LIGHTING - LAGOON						SITE LIGHTING - OPER. BLDG.	15	1	10	20
21										OPERATIONS BLDG. - LIGHTING	16	1	12	22
23	9	15	2	POLYMER FEEDER										24
25	11	45	1	UNIT HEATER										26
27														28
29														30
31														32
33														34
35														36
37														38
39														40
41														42

Specification Section No. 16160

DISTRIBUTION EQUIPMENT
(600 VOLTS AND BELOW)

In accordance with the requirements of the General Conditions and Supplementary General Conditions, the following information is required of the Contractor.

ITEM OR DESCRIPTION	SHOP DRAWINGS	CATALOG DATA	PARTS LIST	OPERATING MANUAL	WIRING DIAGRAM	CERTIFICATION	SAMPLES	OTHER
Power Distribution Panel	X	X	X		X			
Safety Switches	X	X						
Fuses	X	X	X					
Lightning Protection Equipment		X			X			
Transformers	X	X			X			

DIVISION 16 - ELECTRICAL

SECTION 16500
LIGHTING SYSTEMS

1. GENERAL:

1.1 This Section specifies acceptable materials and methods of installation of all equipment to be used for the lighting system including lighting fixtures, poles, etc.

2. MATERIALS:

2.1 Lamps:

2.1.1 Fluorescent lamps shall be of the types and sizes required for the particular fixture into which they are to be installed. All lamps shall be of one manufacturer such as General Electric, Westinghouse or Sylvania. Color shall be cool white unless otherwise stated in this Section or on the Drawings.

2.1.2 High pressure sodium vapor lamps shall be equal to General Electric "Lucalox".

2.2 Ballasts:

2.2.1 Fluorescent fixture ballasts shall be designed to start and satisfactorily operate the type of lamp(s) specified in the particular fixture. Ballasts shall be securely fastened at two (2) points to the mounting surface, making as complete a mechanical contact with the mounting surface as possible. These ballasts shall be high power factor, Class P, Class A sound rating, CBM certified, Underwriters' Laboratories listed.

2.2.2 Ballasts for high intensity discharge fixtures shall be designed to start and successfully operate the type of HID lamp required for the fixture. These ballasts shall be high power factor type. No lamp shall be installed into a fixture which has a ballast that has been manufactured to operate a different type of lamp. Ballasts shall be Underwriters' Laboratories listed.

2.2.3 Ballasts as manufactured by Jefferson, General Electric, Advance, Universal, Holophane, Wide-Lite, or equal will be acceptable.

2.3 Ballast Fusing:

2.3.1 High intensity discharge type ballasts shall each be protected against overload and short circuit by fuses equal to Bussman Type KTK fuses in Type HEB fuseholders. Fuses shall be located approximately one (1) foot from the ballast except for pole mounted fixtures. The fusing for pole mounted fixtures shall be located approximately 1 foot to 18 inches above the base, in-line in the wiring, behind a screw-driver operated cover in the conduit fitting or in the junction box on the wooden poles.

2.4 Lighting Fixtures:

2.4.1 Fluorescent fixture housing, chassis and/or channels shall be not less than 20 gauge steel, of rigid construction, and,unless otherwise specified, shall have a finish equal to baked-on white enamel over a zinc phosphate undercoating. Reflectors shall be fabricated of not less than 22 gauge steel which shall have a finish equal to baked-on white enamel. Reflectors shall have an INITIAL reflection factor of not less than 0.85.

2.4.2 Fluorescent lampholders shall be of such design that the lamp will be held firmly in place, electrically and mechanically secure, and shall be located such that they permit easy insertion or removal of lamps. Lampholders shall be rigidly and securely fastened to the mounting surfaces with the necessary provisions to prevent the lampholders from turning. The dimensions of the lampholders shall be located to position the tube so that the reflectance pattern is such to give maximum lumen output from the fixture and also to provide the electrical properties necessary to successfully operate the lamp.

2.4.3 Ballast compartments and housings for high intensity discharge type fixtures shall be cast type of the size and shape necessary to contain transformers, capacitors, fuses, etc., necessary for the operation of the fixture. Housings shall be formed with heat-sink fins or other means to properly dissipate the heat from the fixture. Lampholders shall be of the size and rating suitable for the particular fixture and shall be mounted such that the lamp is properly positioned within the reflector space.

2.4.4 Wiring within the ballast compartments shall be secured to the chassis or housing with clips or other similar means. Wiring insulation within the compartments shall be rated for the heat produced by the ballasts and the lamp(s).

2.4.5 Fixture letter designations shown on the drawings correspond to the type as specified in the schedule below. Fixture manufacturers and catalog numbers are given to establish standards, quality of workmanship, and general appearance provided by the manufacturers and by no means are intended to restrict the Contractor to the particular fixture mentioned. Lighting fixtures submitted for approval as a substitute to those mentioned in the schedule will be CAREFULLY scrutinized to see that they meet the actual specifications herein and other qualities of the mentioned fixture and are, in the opinion of the USEPA OSC, equal to the fixture specified. The Contractor shall be solely responsible for proof-of-equality of any fixture submitted for approval in accordance with Section 01300: SUBMITTALS AND SUBSTITUTIONS.

2.5 Lighting Fixture Schedule:

Type A - Two (2) F40T12/CW/RS/WM, rapid start, 35 watt energy saving lamps, dust and moisture resistant, prismatic acrylic enclosure, steel chassis -

corrosion resistant, 277 volt fused ballast. Enclosure shall be secured with stainless steel fasteners and, when unfastened, supported by bead chains. Fixtures equal to Holophane "Prismatite" or Miller "DMR" will be acceptable.

Type B - Fixtures equal to Holophane "Petrolux", cast guard, prismatic refractor, stanchion mount, 277 volt, 70 watt high pressure sodium. Mounting shall be at a nominal 8'-0" from finished grade and as detailed on the Drawings.

Type B-1 - Same as type B except with wall mounting bracket for mounting on wooden poles as detailed on the Drawings.

Type B-2 - Same as type B except outlet box mounted as detailed on the Drawings.

Type B-3 - Same as type B except mounted as shown on the Drawings.

3. EXECUTION:

3.1 Installation of lighting fixtures shall be in strict compliance with suggested and mandatory rules and regulations given in applicable articles of the latest edition of the National Electrical Code (1981).

3.2 Some fixture installation particulars are detailed on the drawings. Where no detail is shown, fixtures shall be installed using normal workmanlike procedures and methods and making use of standard equipment available in the industry. Where doubt arises concerning the installation of a fixture or fixtures, the Contractor shall coordinate with the USEPA-OSC before installation begins. Weights, sizes, knockouts, mounting studs and holes shall be obtained from the manufacturer of the particular fixture involved before installation procedures begin. Generally installation shall follow specification contained herein.

3.3 Some fixtures are to be mounted directly to the structural steel or to steel channel such as Unistrut or Kindorf channel which is, in turn, mounted to the structural steel. Mounting to the steel will be accomplished by the use of standard beam clamps, clips, etc. manufactured and approved for that purpose. Mounting to the steel channel will be accomplished by use of fittings designed and manufactured for use with the particular steel channel being used.

4. TESTING:

4.1 Refer to Section 16999: ELECTRICAL FIELD ACCEPTANCE TESTS for testing procedures.

In accordance with the requirements of the General Conditions and Supplementary General Conditions, the following information is required of the Contractor.

ITEM OR DESCRIPTION	SHOP DRAWINGS	CATALOG DATA	PARTS LIST	OPERATING MANUAL	WIRING DIAGRAM	CERTIFICATION	SAMPLES	OTHER
Lamps		X						
Ballasts		X						
Ballast Fusing	X	X			X			
Lighting Fixtures (All Types)	X	X	X		X			

DIVISION 16 - ELECTRICAL

SECTION 16999
ELECTRICAL FIELD
ACCEPTANCE TESTS

1. GENERAL:

1.1 After the electrical installation is complete, tests shall be made to demonstrate that the entire system is in proper working order and in accordance with the Drawings and Specifications. In no case shall the tests be less than those outlined hereafter unless requested in writing by the Contractor and permitted by the USEPA OSC. The tests outlined herein shall be in addition to, and not substitution for, the tests of the individual items at the manufacturer's plant. Insulation and ground resistance tests shall be made before operating tests. Proper rotation of motors shall be determined before permanent connections are made.

1.2 The cost of the retests shall be borne by the Contractor when the retests are occasioned by defects and failures of equipment to meet the specifications.

1.3 All wiring and equipment found defective, or failing to meet the specified requirements, shall be replaced by the Contractor without charge, unless written permission for repair is given by the USEPA OSC.

1.4 The Contractor shall furnish four copies of all test results to the USEPA OSC.

1.5 The Contractor shall provide suitable electrical instruments including voltmeter, ammeter, wattmeter, tachometer and megger. The Contractor shall furnish certified copies of the calibration curves of the instruments which shall have been calibrated for these specific tests.

1.6 The Contractor shall make the necessary openings in the circuits for the testing instruments and shall place and connect all instruments, equipment, and devices, necessary for the tests. Upon completion of the tests, the instruments and instrument connections shall be removed and all circuits shall be restored to their permanent condition by the Contractor.

1.7 Other Sections of the Specifications require the services of one or more manufacturer's representatives, to ensure that equipment supplied has been installed properly and adjusted to proper working order. The Contractor shall advise the representatives of all applicable tests in this Section, so that the work will be coordinated, and tests shall be combined where feasible.

1.8 The tests shall be conducted in the presence of the USEPA OSC. He shall be notified seven calendar days or more in advance when any test is to take place, and tests shall not be started without his permission.

1.9 Connections at motors, motor control equipment, switchgear, and transformers shall not be made up permanently until correct phase rotation of all the equipment has been determined. These connections shall be installed and insulated temporarily, if necessary, while determining proper rotation. Permanent connections shall be made after proper rotation has been established and subsequent to the completion of the insulation resistance and dielectric tests.

2. INSULATION RESISTANCE TESTS OF CIRCUITS, 600 VOLTS AND LESS:

2.1 Each complete feeder and branch circuit of 600 volts or less, with everything but power supply and power-consuming equipment, connected thereto, shall be tested and shall have an insulation resistance between conductors and between each conductor and ground of not less than 1,000,000 Ohms unless otherwise accepted by the USEPA OSC.

2.2 The insulation resistance values shall be determined with all switchboards, panelboards, fuseholders, switches, receptacles, and overcurrent devices in place.

2.3 A megger having an output of at least 1000 volts shall be used to determine the insulation resistance value.

2.4 Test data shall list each circuit and the measured resistance.

3. INSULATION RESISTANCE TESTS OF MOTORS:

3.1 After installation, the Contractor shall megger the windings of all 3-phase motors. They shall be tested in accordance with, and meet the requirements of, IEEE Standard No. 43-1974, Recommended Practice for Testing Insulation Resistance of Rotating Machinery. The insulation resistance measurements then shall meet or exceed the requirements of the motor manufacturer's published values.

4. OPERATING TESTS:

4.1 Each motor and its associated equipment shall be operated, as nearly as possible, under normal operating conditions for as long as feasible and for a length of time sufficient to demonstrate correct alignment, temperature rise, speed, and satisfactory operation. The motors shall be loaded to full capacity, or as near thereto as possible. Associated equipment includes instruments, meters, relays, circuit breakers, switches, and other devices in switchgear, motor control equipment, panelboards, control and instrumentation panels, etc., related to the motor being tested.

4.2 All switches, circuit breakers and control devices shall be operated to show correct and satisfactory operation.

4.3 Where tests of any of the above-referenced equipment are included in other sections of the specifications, the Contractor shall coordinate the testing to avoid duplication and conflict.

4.4 All lighting fixtures shall be operated to determine if the ballasts, lamps, etc. are operating properly.

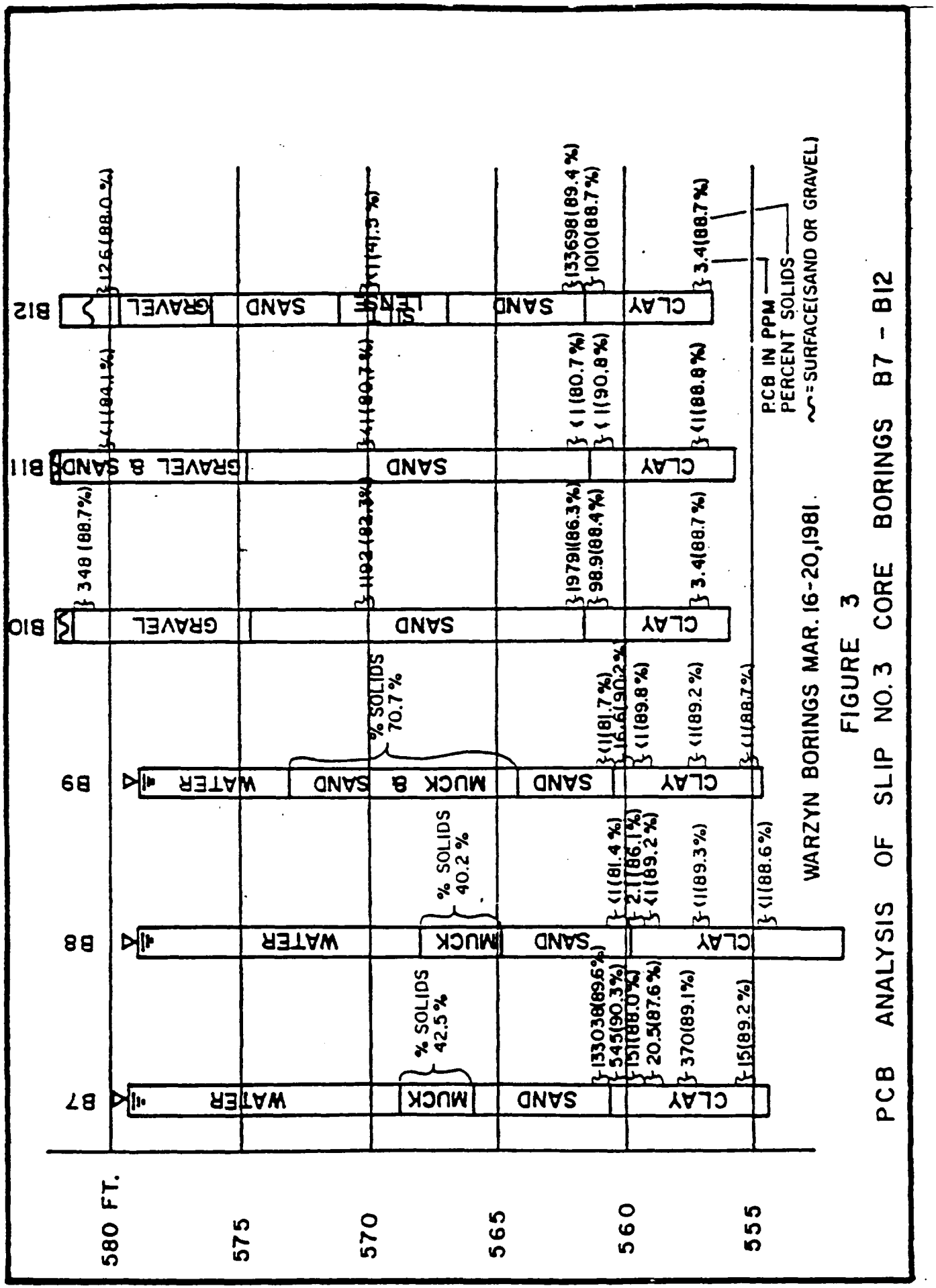


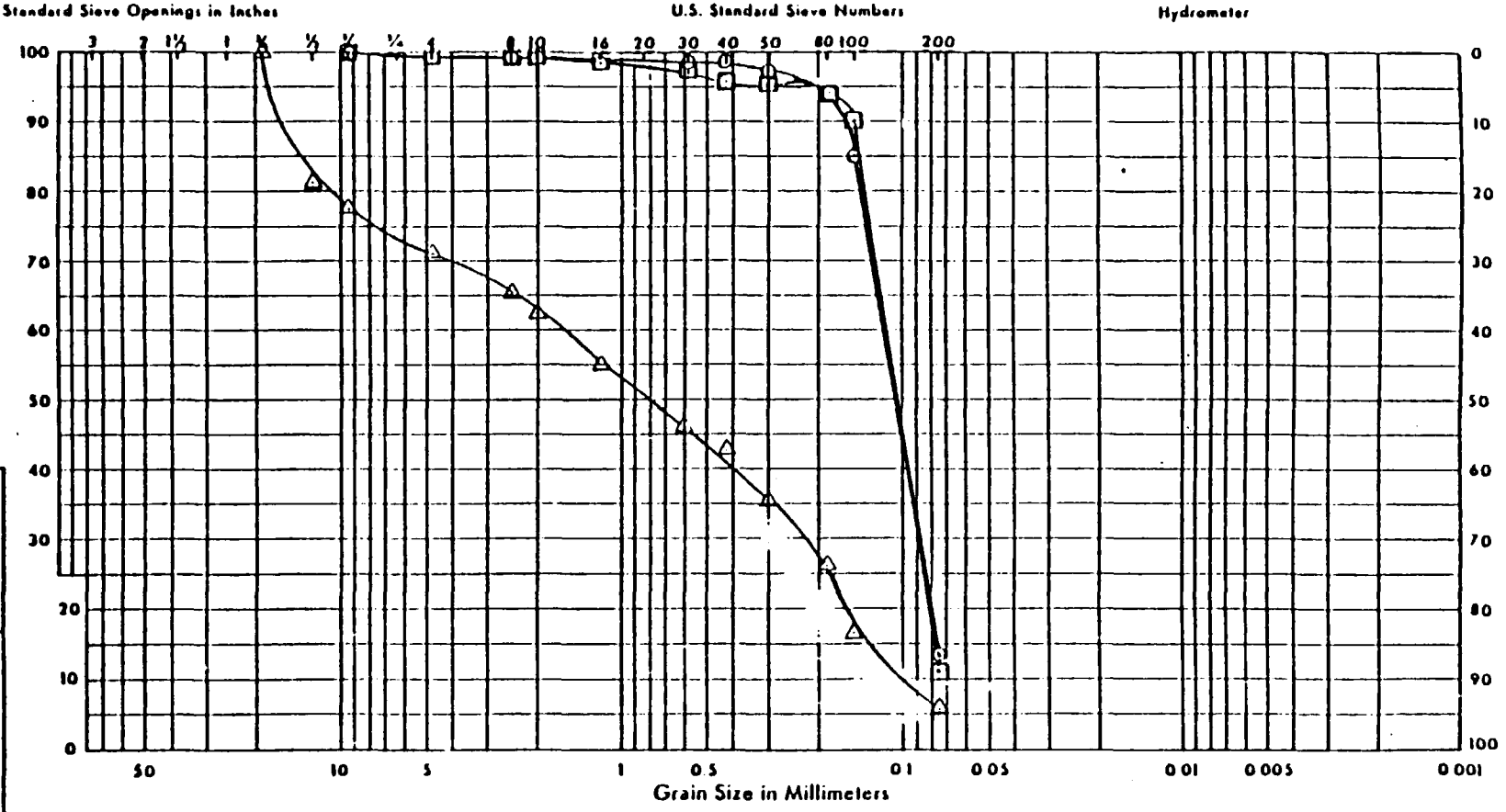
FIGURE 3

PCB ANALYSIS OF SLIP NO.3 CORE BORINGS B7 - B12

DWN LJS | CHK'D GFP | APP'D Dominic Vitti | DATE 1/6/81 | C9560-A5

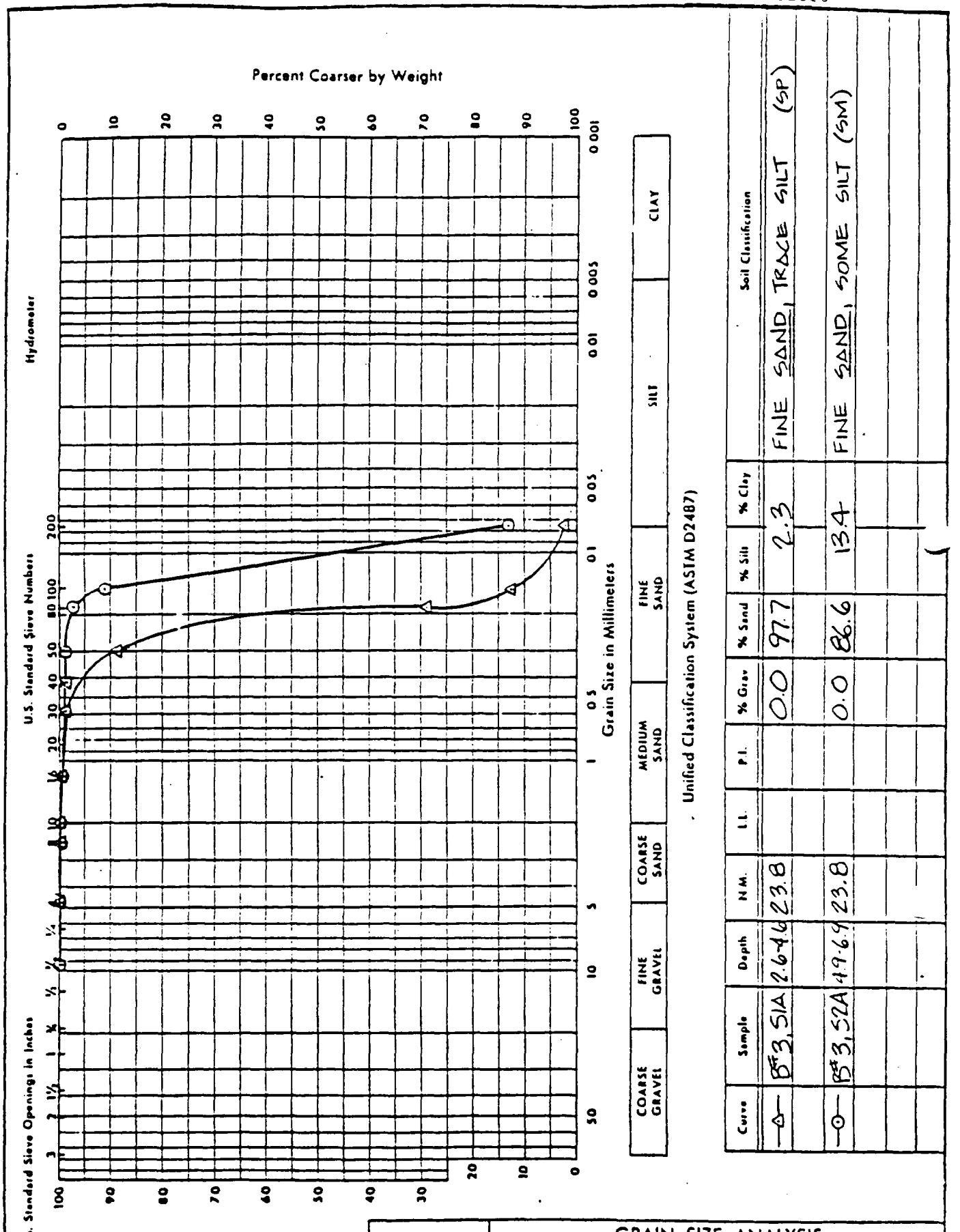
WARZYN ENGINEERING INC

GRAIN SIZE ANALYSIS
SAND SAMPLE COLLECTION
WAUKEGAN HARBOR SLIP #3
WAUKEGAN, ILLINOIS



Unified Classification System (ASTM D2487)

Curve	Sample	Depth	N.M.	L.L.	P.I.	% Grav	% Sand	% Silt	% Clay	Soil Classification
△	B#1, S1A	4.4-6.4	10.2			28.6	65.5	5.9		FINE TO COARSE SAND, LITTLE SILT (SW-SM)
○	B#2, S1A	4.5-6.5	22.5			0.5	85.9	13.6		FINE SAND, SOME SILT (SM)
□	B#2, S2B	7.7-9.7	22.7			0.6	88.4	11.0		FINE SAND, LITTLE SILT (SP-SM)

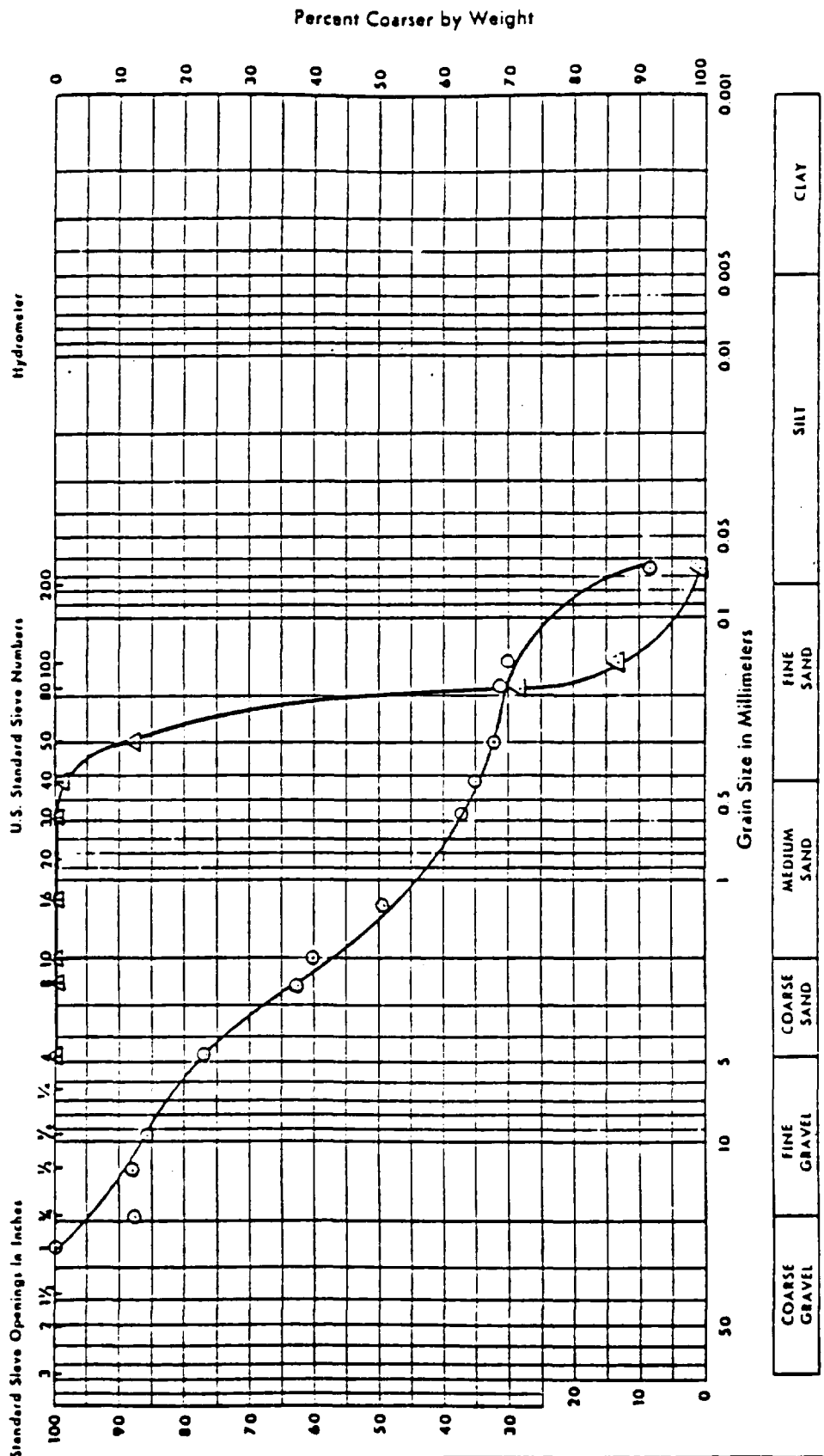


Curve	Sample	Depth	N.M.	L.L.	P.I.	% Grav	% Sand	% Silt	% Clay	Soil Classification
—○—	B#3, S1A	2.6-4.6	23.8			0.0	97.7	2.3		FINE SAND, TRACE SILT (SP)
—○—	B#3, S2A	4.9-6.9	23.8			0.0	86.6	13.4		FINE SAND, SOME SILT (SM)

WARZYN ENGINEERING INC

GRAIN SIZE ANALYSIS
SAND SAMPLE COLLECTION
WAUKEGAN HARBOR SLIP #3
WAUKEGAN, ILLINOIS

DWN KRS	CHK'D GFP	APP'D Daniel R. Vitt	DATE 1/16/81	C9560-A6

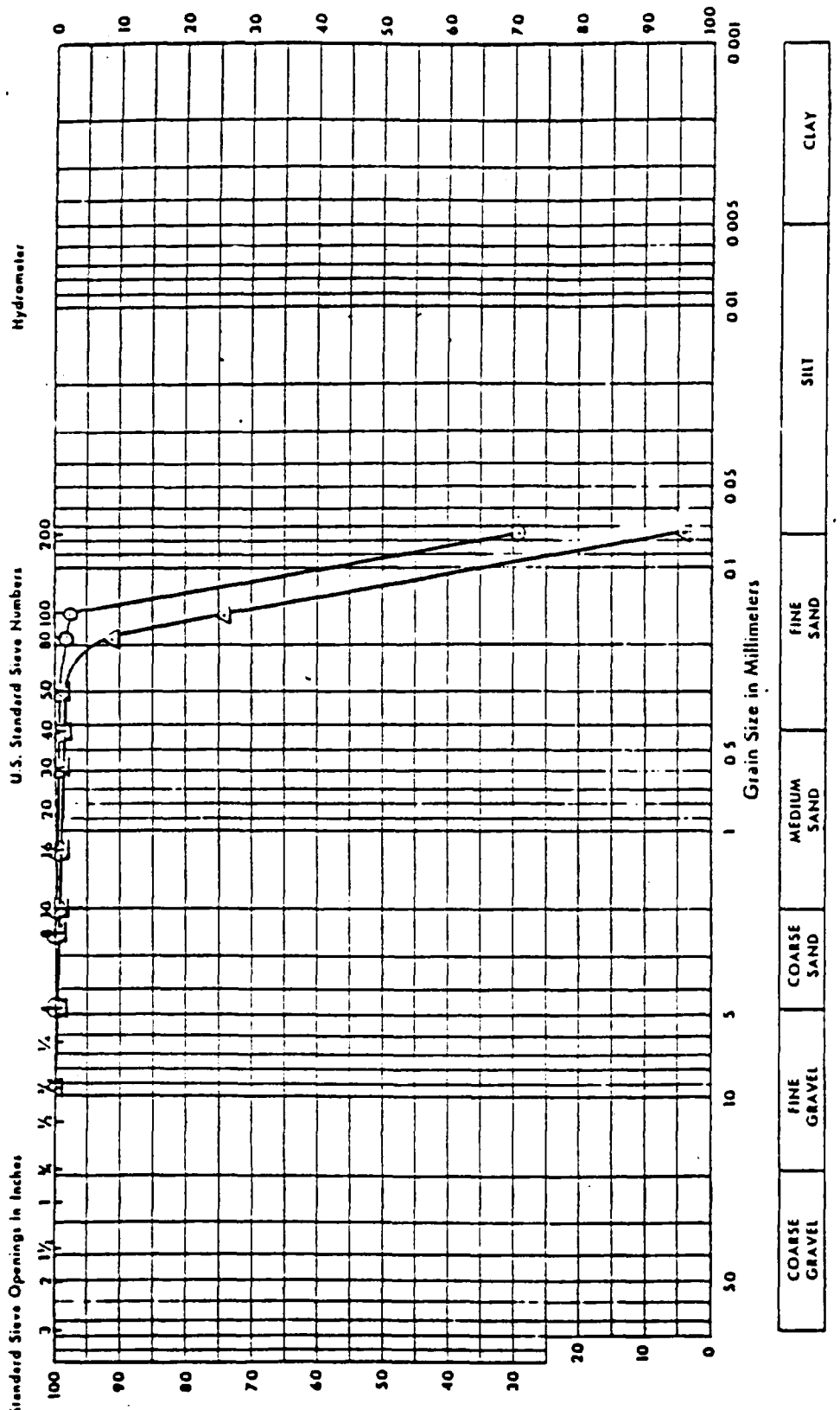


Curve	Sample	Depth	N.M.	L.L.	P.I.	% Grav	% Sand	% Silt	% Clay	Soil Classification
△	B#4, S1A	15-35	19.9			0.0	99.8	0.2		FINE SAND, TRACE TO NO SILT (SP)
○	B#4, S5A	D2-11	11.3			33.0	59.0	8.0		FINE TO COARSE SAND, SOME GRAVEL, LITTLE SILT (SW-SM)

WARZYN ENGINEERING INC

GRAIN SIZE ANALYSIS
SAND SAMPLE COLLECTION
WAUKEGAN HARBOR SLIP #3
WAUKEGAN, ILLINOIS

DWN	CHK'D	APP'D	DATE	
[illegible]	GFP	Daniel R. Vitt	1/6/81	C9560-A7



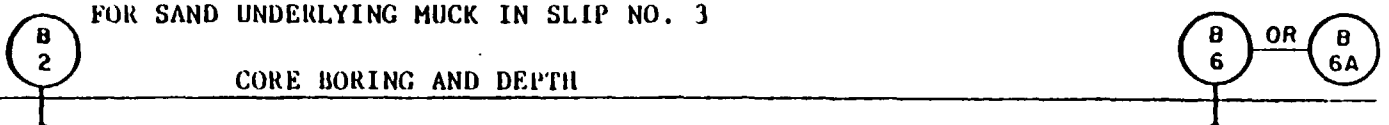
Curve	Sample	Depth	N.M.	L.L.	P.I.	% Grav	% Sand	% Silt	% Clay	Soil Classification
△	B#6A, S1A	3.9-5.9	29.2			0.0	96.1	3.9		FINE SAND, TRACE SILT (SP)
○	B#6A, S3A	8.5-10.5	23.6			0.0	70.7	29.3		FINE SAND, SOME SILT (SP).

WARZYN ENGINEERING INC

GRAIN SIZE ANALYSIS
SAND SAMPLE COLLECTION
WAUKEGAN HARBOR SLIP #3
WAUKEGAN, ILLINOIS

DWN LDS	CHK'D GFP	APP'D Daniel R. Vitt	DATE 1/6/81	C9560-AB

SOIL GEOTECHNICAL INFORMATION FROM WARZYN FOR SAND UNDERLYING MUCK IN SLIP NO. 3

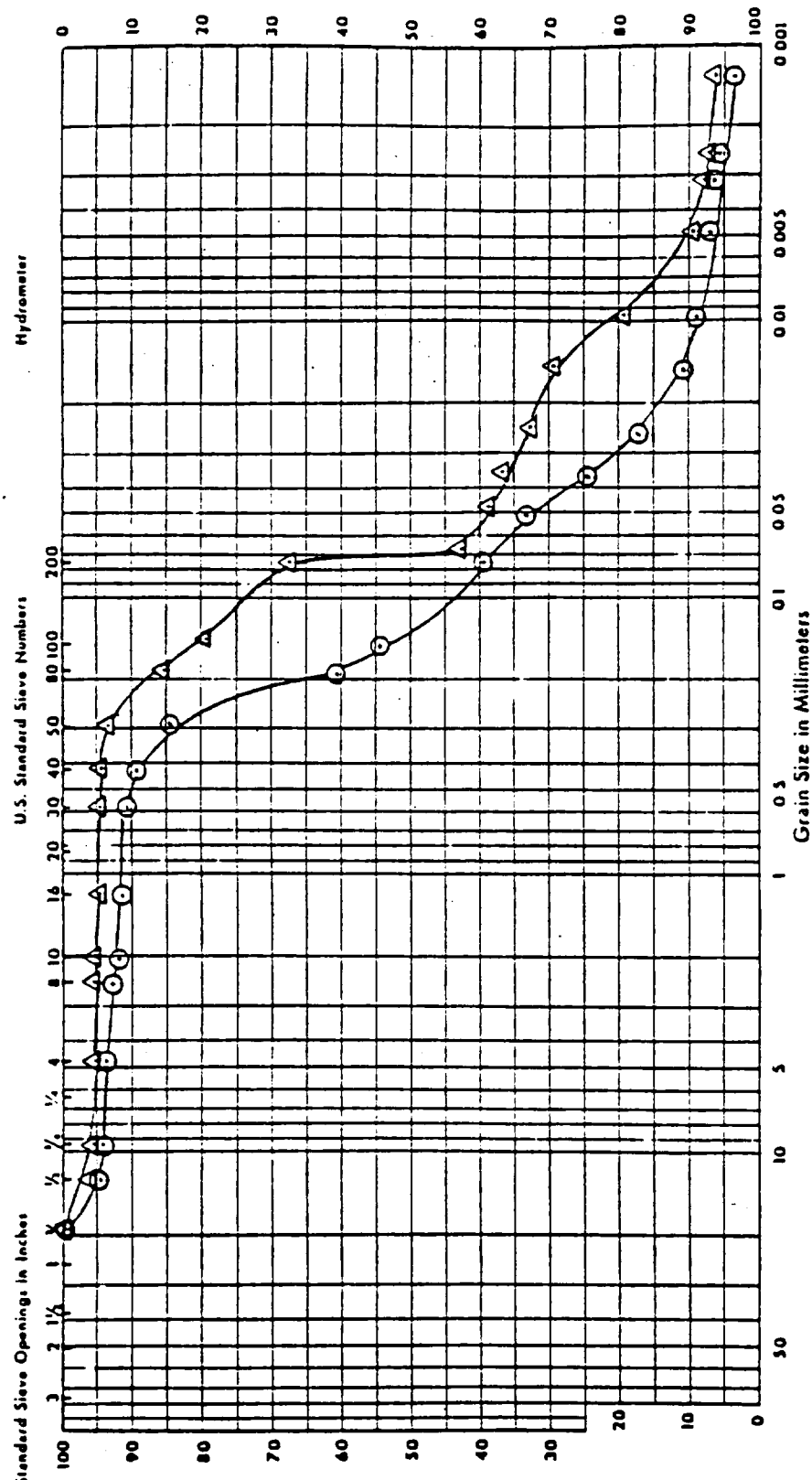


CORE BORING AND DEPTH

Screen Size*	B1-563.7'	B2-565'	B2-564.2'	B3-566.1'	B3-563.8'	B4-567.1'	B4-560.6'	B5-568.5'	B6-567.5'	B6-563.2'
1-1/2"	100	100	100	100	100	100	100	100	100	100
1"	100	100	100	100	100	100	100	100	100	100
3/4"	100	100	100	100	100	100	87.5	100	100	100
1/2"	82.1	100	100	100	100	100	87.5	100	100	100
3/8"	77.7	100	100	100	100	100	85.5	100	100	100
No. 4	71.5	99.5	99.4	100	99.8	100	77.0	98.7	99.4	100
No. 8	65.7	99.4	98.8	99.9	99.6	99.9	63.8	97.7	99.1	99.8
No. 10	63.5	99.3	98.6	99.9	99.6	99.9	60.7	97.6	98.9	99.7
No. 16	55.6	98.9	98.1	99.8	99.5	99.8	49.9	97.4	98.5	99.5
No. 30	46.6	98.7	97.2	98.9	99.3	99.5	37.1	97.3	98.1	99.3
No. 40	43.5	98.6	96.8	98.0	99.1	98.7	35.2	97.2	98.0	99.3
No. 50	35.2	98.0	96.2	88.7	98.9	87.6	33.6	96.8	97.3	99.0
No. 80	26.9	94.4	94.8	28.7	97.4	28.9	31.6	93.9	91.6	98.1
No. 100	16.2	85.3	91.0	12.6	91.7	13.7	30.0	84.6	74.2	97.0
No. 200	6.0	13.6	11.0	2.3	13.4	0.2	8.0	3.7	3.9	29.3
Unified Soil Classification	SP/SM	SM	SP/SM	SP	SM	SP	SP/SM	SP	SP	SM/SC
Density (lbs./cu..ft.)	N.A.	N.A.	N.A.	N.A.	N.A.	107.8	N.A.	106.4	N.A.	N.A.
Natural Moisture	10.2%	22.6	22.8	23.8	23.8	20.0	11.4	22.3	24.2	23.8

*Data is expressed as percent passing a specific screen size. Data will plot as a soil curve.

B1-563.7' means that a 6 inch segment taken from 563.7 to 564.2 foot elevation of boring B1 was homogenized. The weight percent material passing through the screen size is listed.



Unified Classification System (ASTM D2487)

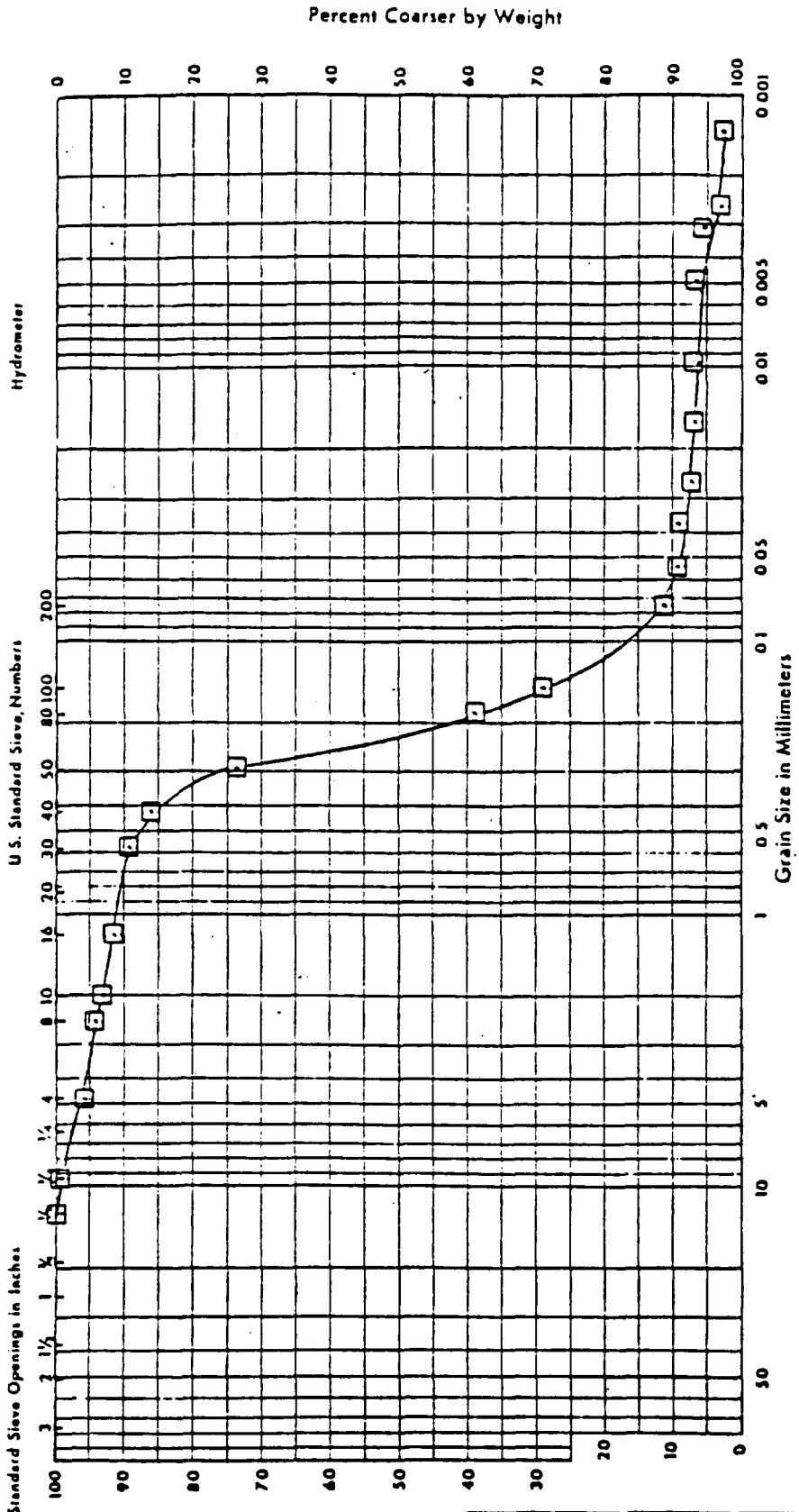
Curve	Sample	Depth	N.M.	L.L.	P.I.	% Grav	% Sand	% Silt	% Clay	Soil Classification
△	B7, MUCK					5	27	58	10	SILT, SOME FINE SAND, LITTLE CLAY, TRACE GRAVEL (ML)
○	B8, MUCK					6	54	32	8	FINE SAND, SOME SILT, LITTLE CLAY, LITTLE GRAVEL (SM)

WARZYN ENGINEERING INC

GRAIN SIZE ANALYSIS

SEDIMENT & SHORE SAMPLE COLLECTION
WAUKEGAN HARBOR SLIP #3
WAUKEGAN, ILLINOIS

DWN JBD, TMS	CHK'D GFP	APP'D	DATE 5/24/81	C9729-A1



Curve	Sample	Depth	N.M.	L.L.	P.I.	% Grav	% Sand	% Silt	% Clay	Soil Classification
⊡	BA, MUCK					3	85	5	7	FINE SAND, LITTLE SILT, LITTLE CLAY, TRACE GRAVEL (SP-SM)

WARZYN ENGINEERING INC

GRAIN SIZE ANALYSIS
SEDIMENT & SHORE SAMPLE COLLECTION
WAUKEGAN HARBOR SLIP #3
WAUKEGAN, ILLINOIS

DWN JBD, TMS	CHK'D GFP	APP'D Robert Kennedy	DATE 5/24/81	C9729-A2

ENGINEERING TEST RESULTS OF MUCK SAMPLES
WAUKEGAN HARBOR SLIP #3
MARCH, 1981

Muck Sample	B7	B8	B9
Wet Density (PCF)	68.79	66.84	68.91
Dry Density (PCF)	29.13	26.88	48.69
% Moisture (dry at 105°C basis)	136.11	148.64	41.53
% Moisture (dry at 20°C basis)	134.25	146.64	40.89
% Solids dried at 105°C	42.35	40.22	70.66
% Solids dried at 20°C	42.69	40.54	70.98

GFP/cgj/dkp
[WEI-7-2]

WARZYN ENGINEERING INC

WAUKEGAN HARBOR CONTAMINATION DATA

Sampling performed by: Central Region Federal EPA, Chicago, Illinois and Illinois EPA, Springfield, Illinois

Date Obtained: Feb. 1977

Analysis performed by: Illinois Natural History Survey Pesticide Laboratory, Urbana, Illinois

Date Performed: March 1977
Information obtained from: Memorandum from Ron Barganz, Field Operations Section, DWPC, to Benn J. Leland, Maywood Office, FOS/DWPC, Illinois EPA, May 16, 1977

Lake elevation: 579.35 USGS Datum

BORING NUMBER	SAMPLE NUMBER	WATER ELEVATION	SAMPLE DEPTH	PCB CONCENTRATION	SOIL TYPE	PERCENT MOISTURE	SAMPLE LENGTH
1	16001	571.35	570.35	141,922/43,669*	Sand*	57.4**	4'-5"
(ILL 1) 1	16002		569.35	19,171/5,574	Sand*	32.0**	Total
1	16003		568.35	34.81/13.85	Sand	18.2	
2C	16008	571.35	570.35	33.24/3.56	Sand/Muck	15.7	4'-5"
(ILL 2) 2C	16009		569.35	0.36/0.12	Sand	16.2	Total
2C	16010		568.35	0.06/0.02	Sand/Gr.	12.2	
2C	16011		567.35	0.29/0.91	Sand/Gr	18.2	
3	16012	570.35	569.35	0.21/0.09	Sand/Muck	26.2	3'-0"
3	16013		568.35	0.40/0.20	Sand	16.2	Total
3	16014		567.35	0.42/0.18	Sand/Gr.	14.7	
5	16020	561.85	560.85	168.52/28.96	Muck	48.2	4'-6"
5	16021		559.85	776.64/152.62	Muck	59.7	Total
5	16022		558.35	2.46/1.40	Muck	58.2	
5	16023		557.85	0.19/0.08	Sand/Muck	46.4	
5	16024		556.85	0.12/0.05	Sand/Muck	51.0	
5	16025		555.85	0.29/0.04	Sand/Muck	51.2	
7	16033	562.35	561.35	102.81/19.36	Muck	54.2	3'-10"
7	16034		560.35	374.78/59.35	Muck	55.2	Total
7	16035		559.35	557.75/85.15	Muck	60.2	
7	16036		558.35	3.56/0.66	Sand	37.2	
(ILL 9) 9	16040	556.35	556.35	28.43/5.31	Muck	45.2	1'-0"
9	16041		555.35	0.04/0.03	Muck	11.4	Total
13	16065	560.35	559.35	8.91/4.01	Sand/Muck	47.0	5'-6"
13	16066		558.35	11.54/4.03	Sand/Muck	26.0	Total
(ILL 13) 13	16067		557.35	3.23/1.03	Sand/Muck	28.4	
13	16068		556.35	9.19/3.83	Muck	50.0	
13	16069		555.35	22.78/9.17	Muck	44.4	
13	16070		554.35	15.21/5.62	Muck	43.2	

* Aroclor 1016/Aroclor 1254
** Identified as sand by sampling agency, however moisture content indicates muck.

WAUKEGAN HARBOR CONTAMINATION DATA

Sampling performed by: Environmental Control Technology Corporation (ENCOTEC)
3893 Research Park Dr., Ann Arbor, Michigan 48104

Date Obtained: April 1977

Analysis performed by: Environmental Control Technology Corporation (ENCOTEC)

Date Performed: April 1977

Information obtained from: Mr. John E. Schenk's (ENCOTEC) Letter with attached Report To Mr. Richard Kissel, December 1977 (M, C, C, S: Sediment Survey April 1977)

Lake elevation: 579.8 USGS Datum

BORING NUMBER	SAMPLE NUMBER	WATER DEPTH	SAMPLE DEPTH	PCB CONCENTRATION	SOIL TYPE	PERCENT MOISTURE	SAMPLE LENGTH
B-1	N/A	N/A	560	0.65	Sand	N/A	1 Ft.
B-1	N/A	N/A	561	0.10	Sand	N/A	1 Ft.
B-1	N/A	N/A	562	0.055	Sand	N/A	1 Ft.
(M 1) B-1	N/A	N/A	563	0.50	Sand	N/A	1 Ft.
B-1	N/A	N/A	564	0.56	Sand	N/A	1 Ft.
B-1	N/A	N/A	565	54	Muck	N/A	1 Ft.
B-1	N/A	N/A	566	28	Muck	N/A	1 Ft.
B-1	N/A	N/A	567	520	Muck	N/A	1 Ft.
B-1	N/A	N/A	568	3400	Muck	32.3	1 Ft.
B-2	N/A	N/A	560	0.99	Sand	N/A	1 Ft.
B-2	N/A	N/A	561	0.32	Sand	N/A	1 Ft.
B-2	N/A	N/A	562	1.5	Sand	N/A	1 Ft.
B-2	N/A	N/A	563	0.31	Sand	N/A	1 Ft.
B-2	N/A	N/A	564	0.35	Sand	N/A	1 Ft.
B-2	N/A	N/A	565	0.20	Sand	N/A	1 Ft.
B-2	N/A	N/A	566	0.54	Sand	N/A	1 Ft.
B-2	N/A	N/A	567	4.1	Muck	N/A	1 Ft.
B-2	N/A	N/A	568	97	Muck	20.0	1 Ft.
B-3	N/A	N/A	559	0.39	Sand	N/A	1 Ft.
B-3	N/A	N/A	561	4.6	Sand	N/A	1 Ft.
B-3	N/A	N/A	561.75	3.0	Sand	N/A	0.75 Ft.
B-3	N/A	N/A	562.25	310	Muck	N/A	1 Ft.
B-3	N/A	N/A	563.25	65	Muck	41.8	1 Ft.
B-4	N/A	N/A	557	310	Muck	N/A	1 Ft.
B-4	N/A	N/A	558.75	3.5	Muck	N/A	1.75 Ft.
B-4	N/A	N/A	559	130	Muck	68.1	0.75 Ft.
B-5	N/A	N/A	556	1.1	Sand	N/A	0.5 Ft.
(M 5) B-5	N/A	N/A	556.5	0.59	Sand	N/A	1 Ft.
B-5	N/A	N/A	557.5	69	Muck	N/A	1 Ft.
B-5	N/A	N/A	558.5	140	Muck	N/A	1 Ft.
B-5	N/A	N/A	559.5	140	Muck	56.3	1 Ft.
B-6	N/A	N/A	556	58	Muck	N/A	0.3 Ft.
B-6	N/A	N/A	556.6	63	Muck	41.8	0.3 Ft.
B-7	N/A	N/A	555	0.32	Clay	16.3	1 Ft.
B-8	N/A	N/A	555	0.062	Sand/Clay	N/A	1 Ft.
B-8	N/A	N/A	555.3	0.054	Sand	N/A	0.3 Ft.
B-8	N/A	N/A	555.6	0.066	Sand	N/A	0.3 Ft.
B-8	N/A	N/A	556.6	5.4	Muck	N/A	1 Ft.
B-8	N/A	N/A	557.1	35	Muck	N/A	0.5 Ft.
B-8	N/A	N/A	558	51	Muck	N/A	1 Ft.
B-8	N/A	N/A	559	1.6	Muck	N/A	1 Ft.
B-9	N/A	N/A	555	0.25	Clay	N/A	1 Ft.
B-9	N/A	N/A	556	0.28	Muck	N/A	1 Ft.
B-9	N/A	N/A	556.5	1.4	Muck	28.1	0.5 Ft.
B-10	N/A	N/A	556	0.083	Clay	N/A	1 Ft.
B-10	N/A	N/A	556.5	0.089	N/A	N/A	0.5 Ft.
B-10	N/A	N/A	557	0.14	N/A	N/A	0.5 Ft.
(M 10) B-10	N/A	N/A	558	0.078	N/A	N/A	1 Ft.
B-10	N/A	N/A	559	0.13	N/A	N/A	1 Ft.
B-10	N/A	N/A	560	1.9	N/A	N/A	1 Ft.
B-10	N/A	N/A	561	0.57	N/A	N/A	1 Ft.
B-10	N/A	N/A	562	9.7	N/A	24.8	1 Ft.

N/A = Not Available

WAUKEGAN HARBOR CONTAMINATION DATA

Sampling performed by: Environmental Control Technology Corporation (ENCOTEC)
3893 Research Park Dr., Ann Arbor, Michigan 48104

Date Obtained: April 1977
Analysis performed by: Environmental Control Technology Corporation (ENCOTEC)

Date performed: April 1977
Information obtained from: Mr. John E. Schenk's (ENCOTEC) Letter with attached Report to Mr. Richard Kissel, December 1977 (M, C, C, S: Sediment Survey April 1977)

Lake elevation: 579.8 USGS Datum

BORING NUMBER	SAMPLE NUMBER	WATER DEPTH	SAMPLE DEPTH	PCB CONCENTRATION	SOIL TYPE	PERCENT MOISTURE	SAMPLE LENGTH
M 11 — H-11	N/A	N/A	556	1.1	N/A	18.3	1 Ft.

Sampling performed by: Environmental Research Group, Inc., (ERG), Ann Arbor, Michigan and Bridgeview, Illinois
Date Obtained: June 1979

Analysis performed by: Environmental Research Group
Date Performed: July 1979

Information obtained from: USEPA - Region V, Enforcement Division, August 1979.

Lake elevation: 579.6 USGS Datum

BORING NUMBER	SAMPLE NUMBER	WATER ELEVATION	SAMPLE DEPTH	PCB CONCENTRATION	SOIL TYPE	PERCENT MOISTURE	SAMPLE LENGTH
S01	S01-1	579.6	574.4	840	Muck		6"
S01	S01-2		574.35	5,000			Total
S01	S01-3		574.27	780			
S01	S01-4		574.18	94			
S01	S01-5		574.10	110			
S01	S01-6		573.77	89			
S02	S02-1		569.1	1,800	Muck		1'-10"
S02	S02-2		568.93	24,300			Total
S02	S02-3		568.77	79,000			
S02	S02-4		568.60	70,400			
S02	S02-5		568.43	55,000			
S02	S02-6		568.27	97,000			
S02	S02-7		568.1	165,000			
S02	S02-8		567.93	470,000			
S02	S02-9		567.77	537,000			
S02	S02-10		567.6	570,000			
S02	S02-11		566.89	140,000			
S03	S03-1		572.53	2,500	Muck		3'-0"
S03	S03-2		572.36	25			Total
S03	S03-3		572.19	20			
S03	S03-4		572.02	1,000			
S03	S03-5		571.85	110			
S03	S03-6		571.68	64			
S03	S03-7		571.51	100			
S03	S03-8		571.34	90			
S03	S03-9		571.17	34,000			
S03	S03-10		571.00	46			
S03	S03-11		570.83	72			
S03	S03-12		570.66	19,000			
S03	S03-13		570.49	59,000			
S03	S03-14		570.32	46,000			
S03	S03-15		570.15	17,000			
S03	S03-16		569.98	440,000			
S03	S03-17		569.81	630			
S03	S03-18		569.64	370			
S07	S07-1		569.64	160	Muck		1'-3"
S07	S07-2		569.48	1,200			Total
S07	S07-3		569.32	620			
S07	S07-4		569.16	1,300			
S07	S07-5		569.00	14,000			
S07	S07-6		568.84	11,000			
S07	S07-7		568.68	3,300			
S07	S07-8		568.52	21			
S08	S08-1		569.8	250	Muck		
S08	S08-2		569.8	1,300			
S08	S08-3		569.8	4,400			
D03	D03-1	579.6	572.53	5,200	Muck		3'-0"
D03	D03-2		572.36	3,100			Total
D03	D03-3		572.19	27,000			
D03	D03-4		572.02	21,000			
D03	D03-5		571.85	19,000			
D03	D03-6		571.68	8,400			
D03	D03-7		571.51	14,000			
D03	D03-8		571.34	120,000			
D03	D03-9		571.17	21,000			
D03	D03-10		571.00	330,000			
D03	D03-11		570.83	200,000			
D03	D03-12		570.66	29,000			
D03	D03-13		570.49	52,000			
D03	D03-14		570.32	74,000			
D03	D03-15		570.15	420,000			
D03	D03-16		569.98	9,100			
D03	D03-17		569.81	330			
D03	D03-18		569.64	310			

Sampling performed by: Environmental Research Group, Inc., (ERG), Ann Arbor, Michigan and Bridgeview, Illinois

Date Obtained: June 1979

Analysis performed by: Environmental Research Group

Date Performed: July 1979

Information obtained from: USEPA - Region V, Enforcement Division, August 1979.

Lake elevation: 579.6 USGS Datum

BORING NUMBER	SAMPLE NUMBER	WATER ELEVATION	SAMPLE DEPTH	PCB CONCENTRATION	SOIL TYPE	PERCENT MOISTURE	SAMPLE LENGTH
S05	S05-1		568.1	970	Muck		3'-0"
S05	S05-2		567.93	2,900			Total
S05	S05-3		567.76	2,300			
S05	S05-4		567.59	3,500			
(ERG 5) S05	S05-5		567.42	8,000			
S05	S05-6		567.25	30,000			
S05	S05-7		567.08	60,000			
S05	S05-8		566.91	30,000			
S05	S05-9		566.74	52,000			
S05	S05-10		566.57	120,000			
S05	S05-11		566.40	76,000			
S05	S05-12		566.23	15,000			
S06	S06-1		569.4	520	Muck		
S06	S06-2		569.3	8,000			
S06	S06-3		569.2	220			
S06	S06-4		569	2,300			
S10	S10-1		566.27	550	Muck		2'-4"
S10	S10-2		566.04	270			Total
S10	S10-3		565.81	240			
S10	S10-4		565.58	290			
S10	S10-5		565.35	300			
S10	S10-6		565.12	1,400			
S10	S10-7		564.89	330			
S10	S10-8		564.66	350			
S10	S10-9		564.43	700			
S10	S10-10		564.20	950			
S12	S12-1		561.50	80	Muck		1'-7"
S12	S12-2		561.32	130			Total
S12	S12-3		561.14	260			
S12	S12-4		560.96	480			
S12	S12-5		560.78	580			
S12	S12-6		560.60	250			
S12	S12-7		560.42	40			
S12	S12-8		560.24	4.9			
S12	S12-9		560.06	0.99 (Bottom)			
S11	S11-1		563.5	230	Muck		1'-7"
S11	S11-2		563.34	95			Total
S11	S11-3		563.18	13/15*			
S11	S11-4		563.02	110			
S11	S11-5		562.86	3			
S11	S11-6		562.70	30			
S11	S11-7		562.54	2.5			
S11	S11-8		562.38	2.7			
S11	S11-9		562.22	0.80			
S11	S11-10		562.06	0.40 (Bottom)			
S07	S07		568.55	59 (Bottom)	Muck		1'-3"
							Total
S09	S09-1		571.1	1.7	Muck		0'-6"
S09	S09-2		570.8	0.14			Total
S09	S09-3		570.6	0.31			
S13	S13-1		560.9	38	Muck		1'-6"
S13	S13-2		560.58	21			Total
S13	S13-3		560.26	8.0			
S13	S13-4		559.94	2.3/3.6*			
S13	S13-5		559.3	0.71 (Bottom)			
(ERG 14) S14	S14-1		561.6	38	Muck		0'-10"
S14	S14-2		561.4	48			Total

Sampling performed by: Environmental Research Group, Inc., (ERG), Ann Arbor, Michigan and Bridgeview, Illinois

Date Obtained: June 1979

Analysis performed by: Environmental Research Group

Date Performed: July 1979

Information obtained from: USEPA - Region V, Enforcement Division, August 1979.

Lake elevation: 579.6 USGS Datum

BORING NUMBER	SAMPLE NUMBER	WATER ELEVATION	SAMPLE DEPTH	PCB CONCENTRATION	SOIL TYPE	PERCENT MOISTURE	SAMPLE LENGTH
S15	S15-1		559.3	32	Muck		1'-11"
S15	S15-2		559.0	17			Total
S15	S15-3		558.71	20			
S15 (ERG 15)	S15-4		558.50	17			
S15	S15-5		558.20	64			
S15	S15-6		557.90	130			
S15	S15-7		557.4	150(Bottom)			
S16	S16-1		564.8	25	Muck		
S16	S16-2		564.5	24			
S16	S16-3		562.4	120			
S16	S16-4		563.9	220			
S16	S16-5		563.6	170			
S16	S16-6		563.3	77/150/170*			
S16	S16-7		563.0	31			
S16	S16-8		562.7	25			
S17	S17-1		558	11	Muck		1'-6"
S17	S17-2		557.8	58			Total
S17	S17-3		557.6	70/130*			
S17 (ERG 17)	S17-4		557.3	64			
S17	S17-5		557.1	7.7			
S17	S17-6		556.9	22/31/33*			
S17	S17-7		556.7	120			
S17	S17-8		556.5	23	Clay Plug		
D17	D17-1		558	24	Muck		1'-3"
D17	D17-2		557.8	25			Total
D17	D17-3		557.5	46			
D17 (ERG 17)	D17-4		557.3	38			
D17	D17-5		557.0	6.2			
D17	D17-6		556.8	42			
D17	D17-7		556.5	110			
D17	D17-8		556.3	27	Clay Plug		
S19	S19-1		559.9	26/30*	Muck		
S19	S19-2		559.7	13			
S19	S19-3		559.5	19/9.5*			
S19	S19-4		559.3	20/16*			
S19	S19-5		559.1	29/12*			
S19	S19-6		558.9	25			
S20	S20-1		556	5.4	Muck		
S20	S20-2		555.8	37/12.6*			
S20	S20-3		555.5	23			
S20	S20-4		555.2	13/13*			
S21	S21-1		556.6	26/12*	Muck		
S21	S21-2		556.4	23/17*			
S21	S21-3		556.2	47/43/48*			
S22	S22-4		556.20	73	Muck		1'-8"
S22	S22-5		556.05	61/48*			Total
S22	S22-6		555.9	22			
S22	S22-7		555.75	11			
S22	S22-8		555.6	3.4/8.8*			
S22	S22-9		555.45	52			
S22	S22-10		555.3	13/12/12*			
S22	S22-11		555.15	9.5			
S22	S22-12		555.0	18			
S22	S22-13		554.85	6.5			
S22	S22-14		554.7	12			
S22	S22-15		554.5	9			
S25	S25-20		564.20	1.6	Muck		1'-8" Total
S26 (ERG 26)	S26-Bottom		558.90	33 (Bottom)	Muck		1'-3" Total

Sampling performed by: Environmental Research Group, Inc., (ERG), Ann Arbor, Michigan and Bridgeview, Illinois

Date Obtained: June 1979

Analysis performed by: Environmental Research Group

Date Performed: July 1979

Information obtained from: USEPA - Region V, Enforcement Division, August 1979.

Lake Elevation: 579.6

BORING NUMBER	SAMPLE NUMBER	WATER ELEVATION	SAMPLE DEPTH	PCB CONCENTRATION	SOIL TYPE	PERCENT MOISTURE	SAMPLE LENGTH
S27	S27-1		555.0	11	Muck		1'-6"
S27	S27-7		554.6	13			Total
S27	S27-10		554.2	25			
S27	S27-11		553.8	9.6			
S27	S27-15		553.4	6.4			
D27	D27-1		555.0	14/56*	Muck		1'-8"
D27	D27-2		554.9	28/8.3*			Total
D27	D27-3		554.8	11			
D27	D27-4		554.7	14			
D27	D27-5		554.6	11.0/6.3*			
D27	D27-6		554.5	5.3/6.3*			
D27	D27-7		554.4	3.1/13*			
D27	D27-8		554.3	6.7			
D27	D27-9		554.2	53			
D27	D27-10		554.1	12			
D27	D27-11		553.0	4.1			
D27	D27-13		553.1	16			
D27	D27-14		553.2	9.5/6.3*			
D27	D27-16		553.3	13			
D27	D27-17		553.3	27			
D27	D27-Bottom		553.3	41			

* Duplicates

WAUKEGAN HARBOR CONTAMINATION DATA

Sampling performed by: Civil and Environmental Engineering Department and Water Chemistry Program
University of Wisconsin, Madison, Wisconsin,

Date Obtained: July 17, 1978

Analysis performed by: Water Chemistry Laboratory
660 North Park Street, Madison, Wisconsin 53706

Date Performed:

Information obtained from: Final Report on Sediment Sampling, Water Sampling, and PCB Analysis in Lake Michigan to JRB Associates, Inc., July 1980.

Lake elevation: 580.3 USGS Datum

BORING NUMBER	SAMPLE NUMBER	WATER ELEVATION	SAMPLE DEPTH	PCB CONCENTRATION	SOIL TYPE	PERCENT MOISTURE	SAMPLE LENGTH
WIS 1 — W-1	N/A	575.4	575.4	146/215/361*	N/A	14.3	N/A
W-2	N/A	572.4	572.4	1876/1758/3634	N/A	20.6	N/A
W-3	N/A	570.8	570.8	755/18/773	N/A	49.5	N/A
W-4	N/A	572.4	572.4	386/79/464	N/A	31.0	N/A
W-5	N/A	566.2	566.2	162/19/182	N/A	57.0	N/A
W-6	N/A	564.2	564.2	110/18/128	N/A	64.9	N/A
W-7	N/A	564.2	564.2	28/15/43	N/A	59.6	N/A
W-8	N/A	564.2	564.2	20/15/35	N/A	53.1	N/A
WIS 10 — W-9	N/A	560.3	560.3	3/5/8	N/A	57.2	N/A
W-10	N/A	565.2	565.2	3/9/12	N/A	64.2	N/A
WIS 13 — W-13	N/A	558.3	558.3	7/20/27	N/A	34.2	N/A
W-14	N/A	560.3	560.3	5/5/10	N/A	41.1	N/A
W-15	N/A	558.3	558.3	7/13/20	N/A	50.4	N/A
W-16	N/A	564.3	564.3	2/7/10	N/A	67.0	N/A
W-17	N/A	560.3	560.3	3/8/11	N/A	60.9	N/A
WIS 18 — W-18	N/A	562.3	562.3	4/8/12	N/A	41.8	N/A

* Aroclor 1242/Aroclor 1248/Total
NA = Not Available

WAUKEGAN HARBOR
RALTECH SCIENTIFIC SERVICES, MADISON, WISCONSIN

	Sample	Percent Solids	Percent Volatile Solids	Oil & Grease	COD	PCB (as is)	PCB (dry basis)
WZN 1	Sediment, Location 1	53.3	3.5	0.385	41,600	72.6	143
	Sediment, Location 2	42.6	4.5	0.610	55,800	106	249
	Sediment, Location 3	38.0	4.3	0.618	64,100	31	81.6
WZN 5	Sediment, Location 4	54.4	4.1	0.309	53,400	28.6	34.2
	Sediment, Location 5	41.0	3.6	0.204	39,500	11.4	27.8
WZN 1	Clay (top), Location 1	89.6	Not Done	Not Done	Not Done	< 1	< 1
	Clay (bottom), Location 1	89.8	Not Done	Not Done	Not Done	< 1	< 1
WZN 2	Clay (top), Location 2	87.1	Not Done	Not Done	Not Done	< 1	< 1
	Clay (bottom), Location 2	87.7	Not Done	Not Done	Not Done	< 1	< 1
WZN 3	Clay (top), Location 3	88.7	Not Done	Not Done	Not Done	< 1	< 1
	Clay (bottom), Location 3	88.6	Not Done	Not Done	Not Done	< 1	< 1

Remarks: Percent Solids: Sample dried at 105 degrees C
Percent Volatile Solids: Sample dried at 550 degrees C
Oil & Grease: Percent oil and grease, dry weight (105 degrees C) basis
COD: mg/kilogram of sample as received
PCB: mg/kilogram of sample as received or on a dry weight (105 degrees C) basis (Arochlor 1242 unless otherwise stated)

PHYSICAL MEASUREMENTS OF WAUKEGAN HARBOR SEDIMENT SAMPLES
MEASUREMENTS BY MASON & HANGER; PERCENT SOLIDS BY RALTECH

Location	Percent Solids (as collected)	Percent Solids (Settling)	Density (as collected)	Density (Settling)	Sieve Analysis, Percent 5	18	35	70	200
WZN 1 — 1 (Sediment)	53.3	63	1.40	1.51	13.04	21.38	27.02	52.34	72.70
2 (Sediment)	42.6	50	1.36	1.45	1.39	5.15	10.05	20.27	35.66
3 (Sediment)	38.0	44	1.30	1.36	0.35	1.78	3.87	9.15	24.15
WZN 5 — 4 (Sediment)	54.4	56	1.60	1.63	1.46	4.64	7.92	14.50	25.07
5 (Sediment)	41.0	47	1.29	1.35	1.74	3.22	6.54	13.25	27.85
2 (Clay)	87.7	87.7	1.78	1.78	10.05	18.18	19.19	20.62	27.20

Remarks:

Percent Solids (as collected): percent solids (by weight) of sample as collected from Harbor bottom.
Density (as collected): density (grams/cc) of sample as collected from Harbor bottom.
Percent Solids (Settling): calculated percent solids after settling 6 weeks.
Density (Settling): calculated density (grams/cc) after settling 6 weeks.
Sieve Analysis: percent solids retained by indicated Taylor Screen Scale Size

*No. 5 screen retained organic debris rather than gravel; the other screens retained sand.

DIVISION 2 - SITEWORK

SECTION 02380
COFFERDAM

1. GENERAL: This Section of the Specifications covers the design, construction and performance of the double wall cofferdam and other related items within the cofferdam area.

1.1 Schedule: The cofferdam shall be constructed only after the dredging operation is complete in the Slip Number 3 area.

1.2 Submittals: The following shall be submitted for approval in accordance with the Section 01300: SUBMITTALS AND SUBSTITUTIONS.

1.2.1 Contractor Qualifications: The Contractor shall submit qualifications of personnel to be engaged in the cofferdam construction. Personnel shall be actively engaged in cofferdam construction and shall have a minimum of three years experience in that field.

1.2.2 List of similar projects done in the last three years.

1.2.3 Design Calculations: The Contractor shall submit, for review, the design calculations for the cofferdam. Calculations shall include but not necessarily be limited to those required for stability, load pressures from earth and water, dewatering, and determination of pile cut off elevation.

1.2.4 Shop Drawings: Shop drawings along with catalog cuts, templates and erection details, as appropriate, for the cofferdam and all structural and miscellaneous items related to the cofferdam shall be submitted for approval.

2. MATERIALS:

2.1 Sheet Piling and Bracing: The size and shape of materials shall be selected by the Contractor based on the design requirements.

2.2 Fill Between Cofferdam Walls: The area between the cofferdam walls shall be filled with bentonite.

2.3 Pipe: The existing intake pipe material is unknown. The Contractor shall remove the pipe as required and replace as specified hereinafter. Any new pipe shall be of the same quality and kind of material as the existing.

2.4 Miscellaneous Metals: Miscellaneous metals shall be as specified in Section 05100: STRUCTURAL AND MISCELLANEOUS METALS.

2.5 Concrete: Concrete shall be as specified in Section 03300: CAST-IN-PLACE CONCRETE.

2.6 Select backfill material shall be a material as classified by the Unified Classification as GW, GP, GM, GC, SW or SC.

2.7 Aggregate: Aggregates shall consist of gravel or crushed stone. Aggregates shall be free from an excessive amount of lumps or balls of clay, or other objectionable matter, and shall be durable and sound. Aggregate, as specified, shall conform to the following gradation:

Percentage by Weight Passing
Square Mesh Laboratory Sieves

Sieve Size	Percent Passing
2 inch	100
1-1/2 inch	70-100
1 inch	45-80
1/2-inch	30-60
No. 4	20-50
No. 8	16-42
No. 40	5-25
No. 200	0-8

3. EXECUTION:

3.1 Cofferdam Location and Dimensions: The cofferdam shall be located in plan as shown on the Drawings. The interior wall of the cofferdam shall be of the diameter shown on the Drawings. The diameter of the exterior wall shall be as required for the Contractor to excavate between the walls but shall be no less than 10 feet larger in diameter than the interior wall. The length of the sheet piling shall be determined as required by the design to meet both the requirements for stability and dewatering.

3.2 Cofferdam Design: The Contractor shall submit all design calculations for review as specified hereinbefore under paragraph "Submittals". The depth of sheet piling for the walls shall be based on the depth of proposed excavation shown on the Drawings and on the test hole logs, stability of the cofferdam, and as required to prevent boil of materials in the bottom surface of the cofferdam as result of the flow of groundwater under the cofferdam walls. The Contractor must be aware that there may be areas, in addition to the areas where test holes were taken, that will require deeper excavation based on results of further testing inside the excavated area. Consideration shall be given by the Contractor in the cofferdam design to ensure that dewatering of the cofferdam area does not have any effect on the bearing value of the earth under the adjacent structures.

3.3 Pile Driving: Sheet piling shall be driven in a true vertical position and to the depths as shown on approved erection drawings. Cofferdam bracing shall be provided as required by the design and as shown on approved erection drawings.

3.4 Bentonite Between Walls: After the cofferdam walls are erected, the evacuated space between the rings shall be filled with a bentonite clay. The bentonite clay shall extend from one foot below the top of the underlying clay layer to an elevation which is one foot above high water. The bentonite shall be placed in a manner that will prevent infiltration of water through the cofferdam. Bentonite is not available on site.

3.5 Dewatering: After the completion of the cofferdam, including the installation of the bentonite clay between the walls, the interior area of the cofferdam shall be dewatered. The Contractor is responsible for the design, installation and performance of the dewatering system. Water pumped from the cofferdam shall be pumped to the lagoon by means of piping with watertight joints. Trenches, sumps and pumps shall be provided in the excavation area as required to maintain a dry condition for excavation. Dewatering of the cofferdam shall in no way effect or reduce the bearing strength of the foundation materials under the adjacent buildings. Note: If the dredge piping is not used to transport water pumped from the cofferdam, then any other piping used shall follow the route shown for the dredge piping from Slip No. 3 to the lagoon.

3.6 Excavation: After construction of the cofferdam and dewatering is complete the area inside the interior wall shall be excavated to the depths indicated on the Drawings and the boring logs at specific locations. The material to be excavated is considered to be contaminated and shall be transported to and disposed of in the lagoon as discussed in Section 01030: SPECIAL PROJECT PROCEDURES. When the Contractor completes excavation to the depths indicated on the Drawings and boring logs, he shall discontinue excavation until additional samples can be taken and tested to determine if additional excavation is required and its limits. Excavation within the cofferdam shall be compatible with the dewatering system. The area shall be sloped to trenches or sumps so that infiltrating water can be pumped out and excavation performed in the dry.

3.7 Removal of Bentonite Clay Between Walls: The bentonite clay between the walls of the cofferdam that is within the limits of Slip Number 3 shall be removed down to the original top of sand elevation. The bentonite clay that will be under the aggregate paved area shall be removed to a depth of four feet. The bentonite clay shall be used to backfill in Slip Number 3 as specified under Paragraph: Backfilling. Surplus bentonite shall be removed from the site.

3.8 Backfilling: The excavated area behind the water edge sheet pile retaining wall shall be backfilled with select materials. Material shall be installed in maximum layer depths of 8 inches. Each layer shall be compacted to 95 percent of maximum density as determined by ASTM D 698 Method D. One field density test shall be performed for each 4000 sq. ft. layer of backfill. The area shall be backfilled to a depth of one foot above the top of the intake pipe prior to trench excavation for that pipe. The inside of the cofferdam that is within the limits of Slip Number 3 shall be backfilled to

the original top of sand elevation with the bentonite clay that is used between the cofferdam walls. Where the bentonite is removed between the walls under the paved area, the excavation shall be backfilled with select backfill material as specified hereinbefore.

3.9 Trench Excavation: Trench excavation shall be to grade with sides as near vertical as practical. The width of trench shall be the overall width of the pipe plus 2 feet.

3.10 Shoring and Sheeting: Excavations shall be shored and sheeted with members of sizes and arrangement sufficient to prevent injury to persons, damage to structure, injurious caving, or erosion. Shoring, sheeting, and bracing shall be removed as the excavations are backfilled.

3.11 Intake Pipe and Structure: Water will not be pumped through the existing intake pipe from Slip Number 3 during the dredging and cofferdam operation. The existing intake pipe shall be cut into just outside the limits of the outer wall of the cofferdam and plugged to perfect a tight seal. The Contractor shall not allow any silt or debris to get into the pipe which in turn could get into the pumping and process system. The existing pipe within the limits of the cofferdam and the inlet structure shall be removed. The pipe may be reused as practical. Demolished materials shall be considered as contaminated and transported and disposed of as specified in Section 01030: SPECIAL PROJECT PROCEDURES. After the cofferdam excavation is complete and the water edge sheet pile retaining wall is redriven, the area behind the wall shall be backfilled to the proper elevation for the construction of the new inlet. The intake shall be constructed in accordance with the details shown on the Drawing and the intake pipe laid to match the existing pipe grades.

3.12 Discharge Pipe: The existing discharge pipe that is located within the limits of the proposed cofferdam shall be cut into just outside the limits of the cofferdam and plugged. The pipe from that point to the edge of the water shall be removed and disposed of as contaminated material as outlined in Section 01030: SPECIAL PROJECT PROCEDURES. This pipe shall not be reconnected after the removal of the cofferdam.

3.13 Demolition:

3.13.1 The Contractor shall, either during the construction of the cofferdam or after dewatering, remove the existing sheet piling wall at the edge of the Slip which falls within the limits of the cofferdam. The intake structure and pipe shall be removed as discussed in Paragraph: Intake Pipe and Structure. The sheet piling may be cleaned in accordance with the requirement of Section 01030: SPECIAL PROJECT PROCEDURES and reused. Piling that is not reuseable because of length or damage shall be replaced with new sheet piling. Nonreuseable materials shall be transported and disposed of as specified in Section 01030: SPECIAL PROJECT PROCEDURES.

3.13.2 After completion of the work required using the cofferdam, the sheet piling in Slip Number 3 shall be removed and cleaned in accordance with Section 01030: SPECIAL PROJECT PROCEDURES prior to removal from the site. The sheet piling in the aggregate paved area shall be left in place; however, the tops of the piling shall be cut off at one foot below finish grade of the adjacent aggregate paved area.

3.14 Aggregate Paved Area: The top one foot of the aggregate paved area that is damaged by the cofferdam construction shall be covered with two six inches layers of compacted aggregate. The finish grade of the top layer shall match the existing surrounding grades.

3.15 Testing: After the excavation of the earth materials from the cofferdam to the depths as indicated on the plans, additional earth samples shall be taken at this level to determine the extent of additional contamination. The location and number of samples will be as directed by the USEPA OSC. Based on the results of the testing, additional material will be removed as directed by the USEPA OSC. Testing shall be in accordance with the requirements of Section 01400: TESTING LABORATORY SERVICES. The excavation area within the cofferdam shall be maintained in a dry condition during the period of time required for both testing and obtaining the test results.

Specification Section No. 02380

SECTION 02380
COFFERDAM

In accordance with the requirements of the General Conditions and Supplementary General Conditions, the following information is required of the Contractor.

ITEM OR DESCRIPTION	SHOP DRAWINGS	CATALOG DATA	PARTS LIST	OPERATING MANUAL	WIRING DIAGRAM	CERTIFICATION	SAMPLES	OTHER
Cofferdam	X	X						Erection Details Calculations Contractor Qualifications List of Similar Projects

DIVISION 2 - SITEWORK

SECTION 02396
SILT CURTAINS

1. GENERAL: This Section of the Specifications covers the requirements for the fabrication, erection and performance of the silt curtains and oil booms.

1.1 Schedule: The double Silt Curtain Number 1 and oil booms shall be installed prior to any dredging operation in Slip Number 3. Following completion of dredging and acceptance by the USEPA OSC, the double silt curtain may be removed. Silt Curtain Number 2 and oil booms shall be installed prior to any dredging operations in the Main Channel Area 1 (Upper Harbor) as shown on the Drawings. Upon completion of the "overlap" dredging of Slip Number 3 and prior to the start of dredging in the Main Channel Area 1, the westernmost curtain and oil booms of Silt Curtain Number 1 shall be re-installed and shall remain in place until dredging operations in the Upper Harbor are complete.

1.2 Submittals: The Contractor shall submit the following information in accordance with Section 01300: SUBMITTALS AND SUBSTITUTIONS prior to the fabrication of the curtains and oil booms.

1.2.1 Qualifications: The designer and fabricator shall be a firm with a minimum of three years experience and actively engaged in this type of construction. The Contractor shall submit a list of similar type of projects that he has constructed in the last three years.

1.2.2 Calculations: The Contractor shall submit for review all calculations related to the design of the silt curtains.

1.2.3 Shop Drawings: The Contractor shall submit for approval detailed descriptions and erection details of the proposed silt curtains and oil booms. The submittal shall include catalog cuts, kind and grade of all materials to be used, erection procedures and any other information requested by the USEPA OSC to assess the performance of the curtain.

2. MATERIALS:

2.1 Curtain: The curtain fabric shall be Hypalon reinforced 2-ply minimum of 30 mil thickness, or other equal material as approved by the USEPA OSC.

2.2 Oil booms shall be of standard design with a depth of three feet and shall be fastened as shown on the Drawings.

2.3 Cables, floatation devices, anchorage devices, support piling, and all other miscellaneous items that are required for the installation and performance of the curtain and oil booms shall be as standard with the silt curtain manufacturer and as required by design.

3. EXECUTION:

3.1 Design: The silt curtain details shown on the Drawings are suggestive details only. The Contractor is responsible for the final design, installation and performance of the silt curtain. The manufacturer shall familiarize himself with the environmental conditions of the Harbor prior to any curtain design. The depth of curtain shall be capable of extending from the design high water elevation as shown on the Drawings to the top of sand elevation. Water flow will be allowed around the ends of the curtains as indicated on the Drawings. The curtain shall be designed to withstand the forces from normal fluctuations of the Harbor water level. Provisions shall be made for rapid changes in water level due to a seiche by kick out of the bottom of the curtain, breakaway panels or other approved method.

3.2 Curtain Location: The silt curtains shall be located as shown on the Drawings. The double Silt Curtain Number 1 shall have the larger openings at the end on opposite ends of the double curtain so that normal flow of water in and out of Slip Number 3 will have to flow between the curtains.

3.3 Fabrication: The silt curtains shall be fabricated from approved shop drawings. The top of the curtains shall be provided with floatation devices to maintain the top of the curtain above the water level. The bottom of the curtains shall be provided with continuous weight to serve as anchorage of the bottom of the curtain. The weight shall be of sufficient size so that the bottom of the curtain will cut through the muck layer and rest on the top of sand. The Contractor shall remove one of the silt curtains of Double Silt Curtain Number 1 and rework to the proper dimension for use as Silt Curtain Number 2. The Contractor shall clean the removed curtain in accordance with Section 01030: SPECIAL PROJECT PROCEDURES prior to rework of that curtain for Silt Curtain Number 2.

3.4 Erection: The curtains and oil booms shall be erected at locations indicated on the Drawings and in accordance with approved erection drawings. All erection of the silt curtains and oil booms shall be done from the surface. The use of divers for erection will not be permitted. All anchorage devices or cables that are located where they could be a hazard to pedestrians shall be guarded with wood or steel barricades in accordance with OSHA.

3.5 Demolition: After dredging is complete in Area 1 of the Main Channel of the Harbor and approved by the USEPA OSC the silt curtains, oil booms, and all anchorage devices shall be removed. The Contractor shall clean all materials in accordance with Section 01030: SPECIAL PROJECT PROCEDURES prior to removal of materials from the site.

In accordance with the requirements of the General Conditions and Supplementary General Conditions, the following information is required of the Contractor.

ITEM OR DESCRIPTION	SHOP DRAWINGS	CATALOG DATA	PARTS LIST	OPERATING MANUAL	WIRING DIAGRAM	CERTIFICATION	SAMPLES	OTHER
Oil Booms	X							
Silt Curtains	X							Calculations Contractor Qualifications

DIVISION 2 - SITEWORK

SECTION 02494
CLAY LINER
SURFACE TREATMENT

1. GENERAL:

1.1 The work provided for herein consists of furnishing all labor, material and equipment, and performing all operations required for applying and maintaining a dust palliative until the dredge spoils are removed from the lagoon.

2. MATERIAL:

2.1 The surface treatment material shall be of a type that can be placed directly on the side slopes of the clay liner by spraying or other similar means, and shall be allowed to penetrate and bind the dredge spoils deposited on the clay liner side slopes. The material shall be a Resin-in-water emulsion manufactured under the trade name Coherox, a Polymer emulsion (dust Binder 124) as manufactured by Union Carbide Corporation, or approved equal. The rate of application shall be as recommended by the manufacturer for a non-traffic area and an estimated service life of 2 years. The Contractor shall furnish the USEPA OSC four copies of Catalog data pertaining to the material, and an affidavit signed by a legally authorized official of the Company manufacturing the product attesting that the product meets the requirements of this Section and is acceptable for the use specified herein.

3. EXECUTION:

3.1 Following completion of the dredging operation and the removal of surface water from the lagoon, the surface of the dredge spoils lying on the side slopes of the clay liner shall be treated. The surface of the spoils shall be dried only long enough to allow application of the surface treatment material. Additional treatment or repairs to the treatment shall be made as required to maintain a dust free condition on the side slopes of the lagoon until all dredge spoils are removed from the lagoon.

DIVISION 2 - SITEWORK

SECTION 02881
DREDGING

1. GENERAL:

1.1 Description:

1.1.1 Work included: The work to be performed under this Section of these Specifications consists of:

(1) The controlled removal of contaminated sediments from atop the sand layer on the floor of a portion of Waukegan Harbor;

(2) transporting the contaminated sediments by means of a watertight dredge pipe to the lagoon located adjacent to the Harbor; and

(3) placing the contaminated sediments in the lagoon in uniformly distributed layers.

1.1.2 Related work described elsewhere:

(1)	Supplementary Conditions	Section 00800
(2)	DIVISION 1 - GENERAL REQUIREMENTS	All Sections
(3)	DIVISION 2 - SITEWORK	All Sections
(4)	DIVISION 15 - MECHANICAL	All Sections

1.2 Job Conditions:

1.2.1 The sediment to be dredged from the surface of the sand floor of Waukegan Harbor contains polychlorinated biphenyl (PCB) contamination in excess of fifty parts per million (50 ppm). The water of Waukegan Harbor contains PCB contamination with a level of contamination as high as 250 parts per billion (ppb) being possible. Therefore, dredging techniques and transportation of the contaminated slurry will be controlled to minimize the increase of levels of contamination in the Harbor Waters and to prevent contamination of surfaces adjacent to the Harbor.

1.2.2 The sediment to be dredged from the Harbor has been classified according to the following levels of PCB contamination:

(1) Sediment containing contamination in excess of 500 ppm which is located in the area designated "Slip No. 3" on the Drawings.

(2) Sediment containing contamination less than 500 ppm but greater than 50 ppm and which is located in the area designated "Main Channel Area 1" (Upper Harbor) on the Drawings.

1.2.3 An approximate quantity of sediment to be dredged from each of these areas is shown on the Drawings. Dredging of the sediment shall proceed at production rates set out in this Section or as approved by the USEPA OSC. Dredging operations in the Upper Harbor shall support the 24 hour per day operation of the water treatment system.

1.2.4 Core borings to determine the character and/or the level of contamination of the sediment to be removed and probings to determine the depths to the sand floor have been made and the results are shown on the Drawings and in Section 02010: HARBOR BORINGS. The location of boulders, stumps, wire rope, or other sunken debris has not been determined. Although tne results of the core borings and the probings are representative of subsurface conditions as of the date they were taken, variations in the sediment location, thickness and character are to be expected.

1.3 The cost of removal of the contaminated sediment from the Harbor floor and for transporting the sediment to the lagoon, as described in this Section and shown on the Drawings, shall not include removal of any boulders, stumps, wire rope, or other sunken debris from the Harbor floor. However, nothing in this Section shall be construed as prohibiting the removal of the excepted material by either the dredge equipment being used or by special equipment. The cost for removal of the excepted material shall be determined and paid in accordance with the GENERAL PROVISIONS.

1.4 The following information shall be furnished with the Proposal and will be used in selecting the Contractor for this work.

(1) Qualifications of dredging personnel based on previous experience with dredging similar sediments and contaminated sediments.

(2) Description of equipment and the dredging technique proposed for use.

(3) A schedule for the dredging of the Upper Harbor that is compatible with and in support of the water treatment schedule.

(4) Documentation proving that equipment to be used will produce the slurry ratios and pumping rates that are specified in this Section.

1.5 It is the intent of this Section of these Specifications to provide for the removal of the maximum amount of contaminated sediments from the floor of Waukegan Harbor while removing an absolute minimum amount of the sand floor of the Harbor. This intent shall be considered in the selection of the dredge to be used in this work.

2. MATERIALS AND EQUIPMENT:

2.1 Dredge piping shall be furnished and installed in accordance with Section 15300: SPECIAL PIPING SYSTEMS AND EQUIPMENT.

2.2 Dredge:

2.2.1 The Dredge(s) used for this work shall be on an American Registered Vessel and manned with an American crew.

2.2.2 The Dredge(s) used for this work shall hydraulically or pneumatically remove the contaminated sediments at the following slurry production rates:

(1) A maximum production rate of 600 cubic feet per minute shall be used in the area designated on the Drawings as Slip No. 3.

(2) A maximum production rate of 1300 cubic feet per minute shall be used in the Harbor area outside of the Slip No. 3 boundary. The minimum rate shall be controlled by the water treatment schedule and rate.

2.2.3 The Dredge(s) shall be capable of removing the sediment and transporting the slurry to the lagoon using the following sediment to water ratios:

(1) Preferred ratio: Slurry to consist of 30 parts sediment and 70 parts water.

(2) Least acceptable ratio: Slurry to consist of 15 parts sediment and 85 parts water.

2.2.4 If used, the hydraulic Dredge(s) shall be equipped to remove sediments when sweeping from both right to left and left to right. This may be accomplished by adjusting the shroud or by opening intakes on the ends, alternately. All water pumped during the dredging operation shall be transported to the lagoon by means of a watertight dredge pipeline.

2.2.5 Control and advancement of the Dredge while in Slip No. 3 and in Area 1 of the Main Channel shall be by use of on-shore tie-offs or other on-shore means.

2.3 A flow meter and density gauge shall be provided and installed in the horizontal dredge pipeline. Readouts shall be located at a readily accessible point to allow the USEPA OSC to periodically monitor the flow to insure compliance with the requirements of this Section.

2.4 Dredge line booster pumps shall be provided and installed as needed to maintain the rates of flow specified in this Section. The pumps shall operate without requiring the addition of either water or solids to the dredge pipe slurry.

2.5 Silt curtains and oil booms as specified in Section 02396: SILT CURTAINS are to contain all oil that may surface during the dredging operation. While dredging is in progress, the Contractor shall have available on-site, for use in collecting the surface oil, two hundred 18 inches by 18

inches by 3/8 inches thick absorbant mats such as those manufactured by the 3M Company, or a comparable product of another manufacturer.

3. EXECUTION:

3.1 Prior to beginning the work of this Section:

3.1.1 In Slip No. 3:

(1) Assure that all docks and supporting piles shown on the Drawings for removal have been removed;

(2) Silt Curtain No. 1 (double) across Slip No. 3 shall be in place; AND

(3) The water in the lagoon including the northeast compartment, shall be removed to a level at elevation 593.0 feet.

(4) Pre-dredging monitoring shall be complete as set out in Section 01400: TESTING LABORATORY SERVICES.

3.1.2 In Area 1 of the Main Channel:

(I) Assure that all docks and supporting piles shown on the Drawings for removal have been removed;

(2) Silt Curtain No. 2 and its oil booms shall be in place;

(3) Assure that the water level in the lagoon does not exceed elevation 611.0 feet; and

(4) The 1500 GPM water treatment system shall be operational.

(5) Pre-dredging monitoring shall be complete as set out in Section 01400: TESTING LABORATORY SERVICES.

3.2 Order of Dredging:

3.2.1 Dredging of Slip No. 3 shall proceed in the following sequence:

3.2.1.1 Probings to determine the depth to top of sediment and top of sand in Slip No. 3 shall be taken along the face of the north sheetpile bulkhead, along the centerline of Slip No. 3, and along the face of the south sheetpile bulkhead. The probings shall be spaced at intervals of 35 feet along each of the lines beginning at the face of the west sheetpile bulkhead. A record of the location of each probing and the two depths measured shall be prepared as reference for determining both quantity of sediment removed and percentage of sediment removed. Two copies of this record shall be furnished the USEPA OSC.

3.2.1.2 Begin dredging at the west end of Slip No. 3 and proceed toward the double silt curtain.

3.2.1.3 Exercise extreme care near sheetpile bulkheads to avoid removal of the sand floor adjacent to the face of the bulkhead.

3.2.1.4 Sediment removed from the floor of Slip No. 3 shall be pumped to the dredge pipe located along the north bulkhead of Slip No. 3; thence, to the lagoon where the sediment shall be deposited evenly over the floor of the northeast compartment of the lagoon.

3.2.1.5 Take all precautions possible to minimize resuspension of the sediments. If excessive turbidity occurs, the USEPA OSC may stop the dredging. See Section 01400: TESTING LABORATORY SERVICES for Dredging Monitoring Program.

3.2.1.6 Upon completion of the dredging in Slip No. 3, probings shall again be taken and the data compared to the data from the record probing. Two copies of this probing data shall be furnished the USEPA OSC.

(1) At least ninety-eight percent (98%) of the sediment shall be removed from the upper 350 feet of Slip No. 3.

(2) At least ninety-five percent (95%) of the sediment shall be removed from the remaining area of Slip No. 3.

3.2.2 Dredging in Area 1 of the Main Channel shall proceed in the following sequence:

3.2.2.1 During this portion of the dredging the Upper Harbor will be closed to traffic.

3.2.2.2 Probings to determine the depth to the top of sediment and top of sand shall again be taken in Slip No. 3 at the locations recorded during the Slip No. 3 dredging. These probings shall be recorded as reference for determining the need for "overlap" dredging (re-dredging), the quantity of sediment removed during "overlap" dredging, and the percentage of sediment removed during "overlap" dredging. Two copies of this record shall be furnished the USEPA OSC.

3.2.2.3 Probings to determine the depth to top of sediment and top of sand in the Upper Harbor shall be taken at all intersection points of the lines of the following grid:

(1) Baseline of grid along the face of the east sheetpile bulkhead of the Upper Harbor;

(2) Gridline running 70 feet west of and parallel to the baseline;

(3) Gridline running 140 feet west of and parallel to the baseline;

(4) Gridline along the face of the west sheetpile bulkhead or at approximately 210 feet west of and parallel to the baseline;

(5) Gridline along the face of the north sheetpile bulkhead of the Upper Harbor;

(6) Gridlines perpendicular to the baseline and located at intervals of 50 feet along the base line, beginning at the intersection of the baseline with the north sheetpile bulkhead and continuing 1150 feet south along the baseline; and

(7) Probings shall also be made at the intersection points of the grid lines with the face of the sheet pile bulkhead of the National Gypsum Company slip located along the west side of the Upper Harbor;

(8) A record of the location of each probing and the two depths measured shall be prepared as reference for determining both quantity of sediment removed and percentage of sediment removed. Two copies of this record shall be furnished the USEPA OSC.

3.2.2.4 The USEPA OSC will review the results of the probings taken in Slip No. 3 to determine the need for and the extent of "overlap" dredging. Unless otherwise directed by the Owner, the USEPA OSC will establish the westernmost limit for the "overlap" dredging of Slip No. 3 as that point at which the sediment depth is recorded to be less than three inches.

3.2.2.5 Begin dredging for the Upper Harbor at the westernmost limit set by the USEPA OSC and proceed toward Silt Curtain No. 2 taking care to operate in a manner that will minimize resuspension of sediments. If excessive turbidity occurs, the USEPA OSC may stop the dredging until an acceptable level of turbidity is attained. See Section 01400: TESTING LABORATORY SERVICES for Dredging Monitoring Program.

3.2.2.6 Sediment removed from the Upper Harbor shall be pumped to the lagoon using the dredge pipe routing that is shown on the Drawings.

3.2.2.7 Fill the lagoon to Elevation 611.0, depositing the slurry in a manner that will distribute the sediment evenly over the lagoon floor (including the compartment containing sediment from Slip No. 3).

3.2.2.8 After the "overlap" dredging is complete and the dredging operation has passed the location of Silt Curtain No. 1, as shown on the Drawings, the westernmost curtain and oil booms of Silt Curtain No. 1 shall be re-installed.

3.2.2.9 When filling of the lagoon is completed, it is intended that the water treatment system be started and that the water from the lagoon be removed and treated. The treatment system will operate for approximately one week without noticeably reducing the water level in the lagoon.

3.2.2.10 After filling the lagoon, the dredging schedule shall be dictated by the rate of the water treatment operation. The dredging schedule shall be such that the top of water level in the lagoon will be maintained at greater than Elevation 607.0 but less than Elevation 611.0, until all dredging is complete.

3.2.2.11 Upon completion of dredging in the Upper Harbor, probings shall again be taken at all points in Slip No. 3 and on the Upper Harbor grid system and the data compared to the data of the record probing. Two copies of this data shall be furnished the USEPA OSC.

(1) At least ninety percent (90%) of the sediment shall be removed from the Upper Harbor and the "overlap" dredged area.

3.2.2.12 When the contaminated sediments have been removed from the Upper Harbor to the satisfaction of the USEPA OSC, the dredging shall be considered complete except for testing as specified in Section 01400: TESTING LABORATORY SERVICES. All dredging equipment and dredge piping shall be removed from the Harbor and the lagoon.

3.3 Upon completion of or during the execution of the work of this Section, all equipment (including piping) that has been in contact with the contaminated sediments shall be cleaned in accordance with Section 01030: SPECIAL PROJECT PROCEDURES before being removed from the Harbor or the lagoon.

DIVISION 2 - SITEWORK

SECTION 02890
DOCKS AND FACILITIES

1. GENERAL:

1.1 This Section covers removal, salvage, and reconstruction work associated with docks and piling at the locations shown on the Drawings, and with utilities connected to or located on the docks. Utilities consist of but are not limited to water, electricity, and fuel pumps.

1.2 Before beginning work of this Section, the Contractor shall coordinate his activities with the USEPA OSC.

1.3 Procedures used for accomplishment of this work shall provide for: protection of adjacent items which are to remain undisturbed; careful removal and disposition of materials that are to be salvaged; coordination with other work in progress; and for safe conduct of this work.

1.4 Material to be salvaged and reused shall be stored on-site within the Construction Limits. All materials designated by the USEPA OSC as scrap material shall become the property of the Contractor or shall be disposed of off-site. Prior to storage, reuse, or disposal, all material shall be cleaned in accordance with the procedures for cleaning contaminated material as described in Section 01030: SPECIAL PROJECT PROCEDURES.

1.5 Explosives shall not be used in this work.

1.6 Burning for the purpose of disposal of scrap material shall not be permitted.

1.7 Any damage to material or utilities to remain, or to materials to be reused which is caused by the Contractor's operations shall be cause for repair or replacement at the direction of the USEPA OSC and at no cost to the Owner.

2. MATERIALS:

2.1 All docks, piling, and miscellaneous items that are removed and are salvageable shall be reused.

2.2 All materials that are removed and are designated as scrap material shall be replaced with new material of an equal quality and kind.

3. EXECUTION:

3.1 Prior to beginning the work of this Section, the Contractor shall identify the docks to be removed, and shall establish and record reference lines, angles, and dimensions for all existing docks and pilings. Top of pile elevations and elevations of holes in piles which are used for intermediate dock levels shall also be recorded. Docks and piling shall be replaced using the recorded reference information.

3.2 The Contractor shall discontinue service and remove utilities connected to the docks. Where necessary provide end caps or plugs for water lines and fuel lines. Electric lines removed shall be coiled neatly and stored on shore in a manner that will protect them from damage during the course of the Work. After disconnection of all water lines is complete, the Contractor shall restore water service.

3.3 The Contractor shall carefully remove the docks and piling that are shown for removal, store them in locations that will not interfere with the work of other Sections of these Specifications, and protect them from damage.

3.4 Following completion of dredging in the Upper Harbor and the removal of the Silt Curtains, docks and piling located outside of the Cofferdam work area shall be replaced in their recorded position.

3.5 Following completion of the work described in Section 02380: COFFERDAM, the remaining docks and piling shall be replaced in their recorded position.

3.6 Piling shall be driven to a minimum depth of 9 feet below the bottom of the Harbor.

3.7 Utilities shall be reconnected to the docks upon replacement of the dock.

DIVISION 3 - CONCRETE

SECTION 03100
CONCRETE FORMWORK

1. GENERAL:

1.1 The design and construction of the formwork shall be the responsibility of the Contractor. The method of forming and the form materials shall be subject to the approval of the USEPA OSC.

2. MATERIALS:

2.1 Forms for surfaces exposed or painted: Form surfaces that will be in contact with concrete shall be of material that is nonreactive with concrete and that will produce concrete surfaces equivalent in smoothness and appearance to that produced by new 4- by 8-foot 5-ply Douglas fir structural plywood not less than 3/4 inch thick of concrete form grade, according to Bureau of Standards, Commercial Standard CS 45.

2.2 Concrete surfaces to be unexposed: Form surfaces that will be in contact with concrete shall be sound, tight lumber or other material producing equivalent finish.

2.3 Form Ties: Ties shall be factory-fabricated, removable or snap-off metal ties of design that will not allow form deflection and will not spall concrete upon removal. Ties shall be fitted with devices that will leave holes in the concrete surface not less than 1/2 inch nor more than 1 inch in diameter and of depth not less than 1 inch and each capable of supporting 3000 pounds.

2.4 Form Coating: The coating shall be a commercial formulation of satisfactory and proven performance that will not bond with, stain, or adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impeded the wetting of surfaces to be cured with water or curing compounds.

2.5 Form Sealer - shall be an approved waterproof nonstaining putty.

3. EXECUTION:

3.1 Construction: Forms shall be constructed to shape, line and grade indicated on the Drawings. Design and tolerances shall conform to ACI 347. All external corners shall be chamfered unless otherwise noted on the Drawings.

3.2 Coatings: Form contact surfaces shall be coated with an approved type of form release agent to prevent bond with the concrete; apply in accordance with the manufacturer's recommendations prior to setting forms in place, and remove excess form release material. Where concrete surfaces are to be painted or otherwise coated, the adhesion shall not be impaired or prevented by the form coating agent. Form surfaces coated with oil, plastic, or lacquer

shall be wetted immediately prior to placing concrete. Coating shall not be allowed to come in contact with reinforcement.

3.3 Removal of forms shall be in a manner to insure complete safety of the structure after the following conditions have been met. Forms shall not be removed until time stipulated in ACI 347, nor shall forms used for curing be removed before expiration of curing period. Care shall be taken to avoid spalling the concrete surface or damaging concrete edges. Wood forms shall be completely removed.

DIVISION 3 - CONCRETE

SECTION 03200
CONCRETE REINFORCEMENT

1. GENERAL:

1.1 Shop Drawings: Prepare and submit for approval complete bending and placing diagrams, in accordance with ACI 315 and CRSI "Manual of Standard Practice".

2. MATERIALS:

2.1 Reinforcing Steel: Reinforcing bars shall be deformed and conform to one of the following: ASTM A 615, ASTM A 616 or ASTM A 617.

2.1.1 All stirrups, ties, and bars less than No. 4 size shall be a minimum of Grade 40.

2.1.2 All other reinforcing shall be a minimum of Grade 60.

2.2 Support accessories shall conform to ACI 315 and include all devices necessary for proper placing, spacing, supporting and fastening steel reinforcement in place.

3. EXECUTION:

3.1 Reinforcement detailing and placement, including concrete protection for steel reinforcement, unless otherwise indicated, shall conform to ACI 318 and 315.

3.2 Reinforcement shall be fabricated to shapes and dimensions shown and shall be placed where indicated. Reinforcement shall be free of loose or flaky rust and mill scale, or coating, including ice, and any other substance that would reduce or destroy the bond. Reinforcing steel reduced in section shall not be used. Reinforcing steel shall not be bent or straightened in a manner injurious to the steel or concrete. Bars with kinks or bends not shown on the Drawings shall not be placed. The use of heat to bend or straighten reinforcing steel will be permitted only if the entire operation is approved. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If bars are moved more than one bar diameter, the resulting arrangement of bars including additional bars necessary to meet structural requirements shall be approved by the USEPA OSC before concrete is placed. Ties shall be made with #16 black annealed wire with ends pointing away from the form.

3.3 Supports shall be provided in conformance with ACI 315 and ACI 318 unless otherwise indicated or specified. Reinforcement for slabs on grade or footings shall be supported on precast concrete units spaced at intervals required by size of reinforcement used, to keep reinforcement the minimum height specified or indicated above the underside of slab or footing. Support materials, fabrication and installation shall be in accordance with ACI 315.

DIVISION 3 - CONCRETE

SECTION 03300
CAST-IN-PLACE
CONCRETE

1. GENERAL:

1.1 All concrete shall conform to the applicable provisions of ACI 318 "Building Code Requirements for Reinforced Concrete" and ACI 301 "Specifications for Structural Concrete for Buildings" except as specified herein.

1.2 Full cooperation shall be given other trades to install embedded items. Before placing concrete, embedded items shall have been inspected and other materials or mechanical installations shall have been completed and approved.

2. MATERIALS:

2.1 Portland Cements: All Portland Cement shall be from fresh stock and conforming to ASTM C 150. Cement shall be Type I or III. Only one brand of cement shall be used except as approved in writing by the USEPA OSC.

2.2 Concrete Aggregates: Shall conform to ASTM C 33 Standard Specifications for Concrete Aggregates.

2.3 Water: All water used in mixing concrete shall be clean, potable, and free from deleterious amounts of acids, alkalies, or organic materials.

2.4 Air-Entrainment: All structural concrete shall be air-entrained concrete. Air entrainment additions to concrete shall conform to ASTM C 260.

2.5 Water reducing admixture may be used when included in the mix design and shall conform to ASTM C 494.

2.6 Curing Materials: (a) Liquid Curing Compound: Shall conform to ASTM C 309. (b) Impervious Sheet Materials: Shall conform to ASTM C 171. (c) Wet burlap.

2.7 Concrete: Concrete shall be a mixture of cement, aggregate, water and other admixtures which are proportioned and mixed for compressive strength at 28 days of 3000 psi.

2.7.1 Admixtures: The use of admixtures requires the written approval of the cement producer and the USEPA OSC unless specified otherwise. Concrete mix shall be adjusted to produce the required rate of hardening for varied climatic conditions:

Under 40 degrees Fahrenheit Ambient Temperature - Accelerate, (Type C ASTM 494). Over 80 degrees Fahrenheit Ambient Temperature - Retardation, (Type D ASTM 494). Between 40 degrees Fahrenheit and 80 degrees Fahrenheit - Normal rate of hardening (Type A admixture as specified).

2.7.2 Mixing: All concrete under these specifications shall be machine mixed. Adequate equipment and facilities for accurate measurement and control of all materials shall be provided conforming to the requirements of ASTM C 94 and available for readily changing the approved proportions to conform with varying job site conditions. Ready mixed concrete shall be used, and shall conform to ASTM C-94 except paragraph 16 is deleted in its entirety.

2.7.3 Batching:

a. Cold Weather Concreting and Batching: Work shall be in accordance with ACI 306.

b. Hot Weather Concreting and Batching: Work shall be in accordance with ACI 305.

2.8 Grout: Grout shall be a non-shrink grout as manufactured by Master Builders, "Embeco"; Savereisen Cements Company, "Level-Fitt Grout F-100"; or equal. Aggregate for the grout shall conform to ASTM C-33 unless furnished by the grout manufacturer.

3. EXECUTION:

3.1 Preparation & Placement: All work shall be in accordance with Chapter 6 of ACI 304-73 Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete. All construction debris and extraneous matter shall be removed from within the forms. Struts, stays, bracing and blocks, serving temporarily to hold the forms in correct shape and alignment, shall be removed. All concrete shall be placed on clean damp surfaces, free from water, or upon properly consolidated fills. Concrete shall be deposited in approximately horizontal layers, not to exceed 18 inches. Wet concrete surface shall not be worked or floated when bleed water is present.

3.2 Vibration:

3.2.1 Concrete shall be consolidated by means of mechanical vibrating. Vibrators shall be inserted and removed vertically at regular intervals to insure uniform consolidation. In no case shall vibrators be used to transport concrete inside the forms.

3.2.2 Internal vibrators shall maintain a speed of not less than 7,000 impulses per minute when in operation. At least one standby vibrator shall be on hand at all times. No form vibrator shall be used without the approval of the USEPA OSC.

3.3 Curing and Protection:

3.3.1 The Contractor shall protect concrete work and cement finishes from too rapid drying, washing, rain, or from frost or injury or defacement of any nature. All surfaces exposed to drying must be kept wet for a period of at least seven days. Concrete which is allowed to become dry or be exposed to

lower ambient temperatures shall be returned to an acceptable state of cure and protection as soon as possible and shall be maintained in that condition for a period of seven (7) days plus twice the length of time the concrete was out of cure and/or protection.

3.3.2 In lieu of wet curing, the Contractor may at his option, use a suitable liquid membrane curing compound conforming to ASTM C 309. Application shall be in accordance with the manufacturer's recommendations. The Contractor will be expected to produce hard, smooth, level, and dustless surfaces and to maintain them in this condition until delivery of the structures to the USEPA OSC. Any concrete found defective by reason of improper materials, excess water, freezing, improper curing, or injury during setting shall be removed and replaced by the Contractor at his own expense.

3.4 Miscellaneous Item Cast Into Concrete: The Contractor shall provide for installation of any embedded devices required for attachment and completion of other work. Location and installation of items shall be as recommended by the manufacturer or as shown on the Drawings.

3.5 Finish: General: All finished surfaces shall conform to Chapters 10 (Finishing of formed surfaces) or 11 (flatwork) of ACI 301.

3.5.1 Finishing of Formed and Vertical Surfaces:

a. Surfaces below grade or water and not exposed to view except as specified herein shall receive a rough or board form finish.

b. Exterior surfaces exposed to view shall receive a grout-cleaned finish.

3.5.2 Finishing of Flatwork:

a. Flat surfaces shall receive a wood float finish.

4. TEST:

4.1 General: All tests, as specified hereinafter for concrete, shall be accomplished only after all materials, including any admixtures permitted, are thoroughly mixed and ready for depositing.

4.2 Test Responsibilities: The Contractor at his expense shall make arrangements with a reputable local testing laboratory to perform all field and laboratory testing for the concrete. Two copies of all test results shall be promptly transmitted to the USEPA OSC.

4.2.1 Compression Test Cylinders: The Laboratory Representative will make all test cylinders. Concrete for test cylinders shall be obtained in accordance with ASTM C 172 "Method of Sampling Fresh Concrete". Cylinders shall be made and placed in cure as specified in ASTM C 31 or delivered to the testing laboratory.

4.2.2 Slump Tests: Slump tests shall be made by the Laboratory Representative in accordance with ASTM C 143.

4.2.3 Air-Entrainment Tests: The Laboratory's Representative shall test the air content of fresh concrete in accordance with ASTM C 173 or C 231.

4.3 Testing:

4.3.1 Compressive Strength Test: One (1) Strength Test consisting of three (3) cylinders shall be made for each 25 cubic yards of concrete or fraction thereof placed in the days operation. Cylinders shall be identified with serial numbers and a record of the placement location shall be maintained.

4.3.2 Slump Test: A Slump Test shall be made and recorded for each compressive strength test. The Laboratory's Representative may make a slump test before placing concrete in the forms and from any particular load of concrete with questionable consistancy delivered to the job site. Allowable slump shall be considered to be 4 inches $\pm$ 1 inch. A slump in excess of 6 inches shall be cause for rejection of that load of concrete.

4.3.3 Air-Entrainment Test: An air-entrainment test shall be made and recorded for each compressive strength test. Concrete shall have an air content of 5 percent $\pm$ 1 percent by volume. If tests indicate poor control of entrained air content, the frequency of such test shall be increased as required to verify air content.

4.3.4 Additional Tests: The Contractor may provide additional tests to obtain advance information for form removal. The USEPA OSC may require additional test specimens cured entirely under field conditions when he has reason to consider the Contractor's methods of curing and protection are inadequate; when the cylinder strength of these specimens falls below strength of laboratory cured cylinders, the USEPA OSC may require additional curing as specified.

4.3.5 Age of Test: Each strength test results shall be the average of two cylinders from the same strength test which are tested at 28 days. One cylinder shall be tested at 7 days to establish an age-strength relationship of the concrete. Cylinders shall be tested in accordance with ASTM C 39.

4.4 Evaluation of Concrete:

4.4.1 The strength level of the concrete will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the required f'c and no individual strength test falls below the required f'c by more than 500 psi.

4.5 Faulty Concrete: Failure to meet the specified conditions and requirements constitutes faulty concrete. Unless otherwise directed by the USEPA OSC faulty concrete shall be removed and replaced with concrete as specified, at no expense to the Owner.

Specification Section No. 03300

SECTION 03300
CAST-IN-PLACE
CONCRETE

In accordance with the requirements of the General Conditions and Supplementary General Conditions, the following information is required of the Contractor.

ITEM OR DESCRIPTION	SHOP DRAWINGS	CATALOG DATA	PARTS LIST	OPERATING MANUAL	WIRING DIAGRAM	CERTIFICATION	SAMPLES	OTHER
Concrete								Mix Design

DIVISION 5 - METALS

SECTION 05100
STRUCTURAL AND
MISCELLANEOUS METALS

1. GENERAL:

1.1 The Contractor will verify all measurements and shall take all field measurements necessary before fabrication. Miscellaneous metal work shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted, exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled to a close fit. Corner joints shall be coped or mitered, well formed and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Work shall be executed and finished in accordance with approved drawings, cuts, details, and samples.

1.2 The AISC SPECIFICATION for the Design, Fabrication and Erection of Structural Steel for Buildings shall govern miscellaneous metals where applicable. Welding shall be in accordance with AWS Code D1.1.

1.3 The Contractor shall provide all materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Materials shall be suitable for the intended usage of the item. Miscellaneous bolts and anchors, supports, braces, and connections necessary for completion of the miscellaneous metal work shall be provided. The necessary rebates, lugs, and brackets shall be provided as required so that the work can be assembled in a neat and substantial manner.

1.4 Qualification of Welders: Certification that each welder is qualified in accordance with AWS Code D1.1 shall be submitted for approval prior to the welder doing any field or shop welding.

1.5 Shop Drawings, along with catalog cuts, templates, and erection and installation details, as appropriate, for all structural and miscellaneous metal items shall be submitted for approval. Submittals shall be complete in details; shall indicate thickness, type, grade, finish, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation.

1.6 Dissimilar Materials: Where dissimilar metals are in contact, the surfaces shall be protected with a coat of bituminous paint, unless otherwise specified, to prevent galvanic or corrosive action.

1.7 Storage of Materials: Material shall be stored out of contact with the ground in such manner and location as will minimize contamination and deterioration.

2. MATERIALS:

2.1 Structural Members, Shapes, Bars and Plates: Shall be manufactured in the United States and shall conform to ASTM A 36 and shall be the sizes and shapes as shown on the Drawings or as required to complete the work. All members to be anchored to concrete shall be provided with studs or other approved anchoring devices.

2.2 Welding Rods: Shall conform to AWS A5.1 or A5.5 Type E70XX.

2.3 Fastening Devices: Bolts and anchor bolts shall conform to ASTM A 307 or A 36 for miscellaneous steel erection. Miscellaneous fastening devices shall conform to ANSI B18.6.3 or B18.6.4.

2.4 Anchorage: Shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts, expansion shields, powder-driven fasteners when approved; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Slotted inserts shall be of the type required to engage with the anchors and shall be approved by the USEPA OSC.

2.5 Screen: The woven wire screen for the intake structure shall be of a square pattern and shall be made of a non-coated weather resistance material to prevent rusting or shall be galvanized.

2.6 Floor Plate: Shall be raised lug pattern steel safety plate having a working stress allowable fiber stress of 16,000 psi minimum.

2.7 Paint: Shop, prime coat and application shall conform to SSPC-PS 7.00. Finish paint shall be a marine quality paint as manufactured by Pratt & Lambert, Pittsburgh Plate Glass, Glidden, Sherwin-Williams or approved equal.

3. EXECUTION:

3.1 Fabrication: Fabrication shall be in accordance with the AISC Manual of Steel Construction, 8th Edition. Welding procedures shall be qualified and performed in accordance with AWS D1.1. Splicing of elements will be permitted only when shown on the Drawings.

3.2 Galvanizing: Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip processed after fabrication. Galvanizing shall be in accordance with ASTM Specification A 123, A 386, or A 525, as applicable.

3.3 Shop Painting: Unless otherwise specified, surfaces of ferrous metal, except galvanized surfaces and steel work to be embedded in concrete, shall be cleaned and shop coated with the manufacturer's standard protective

coating. Bituminous protective coating shall not be used. Surfaces shall be cleaned with solvents to remove grease and oil and with power wire brushing or sandblasting to remove loose rust, loose mill scale, and other foreign substances. Surfaces of items embedded in concrete shall not be painted.

3.4 Connection: Unless noted otherwise all shop connections shall be welded. Field connections shall be bolted or welded as shown on the Drawings.

3.5 Erection: Temporary bracing shall be introduced wherever necessary to take care of all loads to which the miscellaneous steel may be subjected, including erection equipment and its operation. All temporary flooring, planking and scaffolding necessary in connection with the erection of the miscellaneous metal shall be provided as necessary for the completion of the erection work. Burning or drifting to enlarge unfair holes will not be permitted. Holes that must be enlarged shall be reamed. Slotted or poor matching holes shall be cause for rejection, except as noted on the drawings. Anchor bolts, fasteners, washers, and all parts or devices necessary for proper installation shall be furnished and installed. Joints exposed to the weather shall be formed to exclude water.

3.6 Field Priming: After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.

3.7 Finish Painting: The miscellaneous steel of the intake structure shall be given two coats of finish paint. Paint shall be applied in accordance with the manufacturer's recommendations as shown in catalog data which shall be submitted to the USEPA OSC for approval.

3.8 Repair of Damaged Finishes: Damage to primed surfaces shall be cleaned and repaired with primer executed in the same manner as specified for Shop Painting. All zinc coating that has been damaged in handling, transportation, or by welding, or bolting shall be repaired by the application of a galvanizing repair paint. Areas to be repaired shall be cleaned and the slag removed from the welds. Surfaces to which the repair paint is applied shall not be heated and is the responsibility of the Contractor. Repair work covered in this section will be done at no additional cost to the Owner.

Specification Section No. 05100

STRUCTURAL AND
MISCELLANEOUS METALS

In accordance with the requirements of the General Conditions and Supplementary General Conditions, the following information is required of the Contractor.

ITEM OR DESCRIPTION	SHOP DRAWINGS	CATALOG DATA	PARTS LIST	OPERATING MANUAL	WIRING DIAGRAM	CERTIFICATION	SAMPLES	OTHER
Miscellaneous Steel	X							
Welding Operators						X		
Paint		X						

DIVISION 11 - EQUIPMENT

SECTION 11237
PACKAGED WATER
TREATMENT SYSTEM

1. GENERAL:

1.1 Purpose of Water Treatment: All water returned to Waukegan Harbor shall contain less than one part per billion (ppb) of polychlorinated biphenyls (PCB). The Contractor shall be responsible for treating water which has been deposited in the lagoon from dredging operations and from precipitation, and for returning the treated water to Waukegan Harbor. Removal of water is necessary in order to (1) provide lagoon capacity to contain Waukegan Harbor contaminated sediments and (2) permit final removal of contaminated material to a landfill. Final removal of the contaminated materials to a landfill is not part of this Work.

1.2 Term and Capacity of Water Treatment System: The Contractor shall provide and install a 1500 gallon per minute (GPM) water treatment system for treating lagoon water during Upper Harbor dredging operations. After dredging is complete and excess water has been treated, the Contractor shall remove the 1500 GPM water treatment system from the site. The Contractor shall then provide and install a 200 GPM water treatment system to treat rainwater that accumulates in the lagoon before and during final removal of contaminated sediments. Just before final removal of contaminated material but after treatment of accumulated rainwater, the Contractor shall drain the water that has accumulated in the underdrain system. This underdrain water shall be treated by the 200 GPM system and shall then be returned to Waukegan Harbor. The 200 GPM system shall remain in service during the period of time required for removal of contaminated materials from the lagoon and shall be removed from the site upon completion of the removal of the contaminated materials. The Contractor shall be responsible for installation, operation, maintenance, analytical work, and removal of both 1500 GPM and 200 GPM systems. All domestic water used on the site shall be provided by the Contractor.

1.3 Related work described elsewhere:

(1)	Supplementary Conditions	Section 00800
(2)	Special Project Procedures	Section 01030
(3)	Measurement and Payment	Section 01150
(4)	Submittals and Substitutions	Section 01300
(5)	Testing Laboratory Services	Section 01400
(6)	Maintenance and Operations	Section 01850
(7)	Cofferdam	Section 02380

(8) Dredging Section 02881

(9) DIVISION 15 - MECHANICAL

(10) DIVISION 16 - ELECTRICAL

1.4 The following data and drawings shall be submitted in accordance with Section 01300: SUBMITTALS AND SUBSTITUTIONS.

(1) Equipment Layout Drawing

(2) Detailed Drawings of all process piping, utility piping, and drain and vent piping needed to support and operate the equipment being supplied in accordance with this Section.

(3) Catalog data describing equipment and materials to be furnished.

(4) An operating manual containing routine maintenance instructions and complete operation instructions.

2. MATERIALS AND EQUIPMENT:

2.1 Equipment for the 1500 GPM Water Treatment System:

2.1.1 Description: The Contractor shall provide the 1500 GPM water treatment system shown on the accompanying Drawings, including but not limited to filters, carbon adsorbers, monitoring equipment, and all piping, fittings, valves, and control elements necessary to operate the filters and carbon adsorbers. The lagoon, Operations Building, sedimentation basin, equipment pads, clear well, and lagoon intake structure are existing. After dredging is complete and excess water treated, the Contractor shall remove the 1500 GPM system from site except for components which the Contractor may elect to use for the 200 GPM system. The 1500 GPM system will be operated during non-freezing weather; thus, neither a building or heat tracing of pipes will be required.

2.1.2 Redundancy:

2.1.2.1 A spare sand filter and a spare carbon column module shall be provided to ensure that the system is always capable of processing 1500 GPM of water. The redundant spare sand filter shall be in addition to one required for backwash. For example, if 750 GPM sand filters are used, two would be on line, a third would be ready for use when one of the first two require back washing, and fourth filter would be provided as the redundant spare.

2.1.2.2 A spare carbon column module shall be similarly provided. For example, if 500 GPM carbon column modules are used, three would be on line, and a fourth module would be provided as a redundant spare.

2.1.3 Filters:

2.1.3.1 The Contractor shall provide a pressure filter system for removing suspended solids from polymer-treated water prior to carbon adsorption. The number of modules and filter arrangement is not specified.

2.1.3.2 The filters and carbon adsorbers must be arranged such that they fit on the existing concrete equipment pads.

2.1.3.3 Each filter module shall be of the same size and capacity. Enough filter modules shall be provided such that 1500 GPM total can be treated and delivered to the carbon adsorbers when one filter is off line for backwashing. No more than one filter shall be backwashed at the same time.

2.1.3.4 Filtered water such as water from the clearwell shall be used to backwash the filters. The backwash rate shall be consistent with the filter media used. Backwash water shall be returned either to the lagoon or sedimentation basin as controlled by valves shown on the Drawings. A continuous discharge of 1500 GPM from the clear well to the Harbor need not be provided when water is withdrawn from the clear well for filter backwash.

2.1.3.5 The filter effluent shall not exceed 2 ppm suspended solids when the filter feed water has been treated with 15 ppm of a suitable cationic polymer (such as Nalco 8103) followed by 1.5 hours or more retention in the sedimentation basin.

2.1.3.6 The Contractor may use the following feedwater characteristics when sizing the filters:

Suspended solids	15 to 40 parts per million (ppm)
Analysis of suspended solids	
Oil and grease	0.2 to 2 %
Percent volatile solids	2 to 10%
Floating oil	Absent

Air scour should be provided during filter backwash unless the Contractor has evidence that the filter media will maintain its performance during the operating period. The filter hydraulic loading shall be consistent with the filter media used, and in no case should the hydraulic loading exceed 7.0 gpm per square foot.

2.1.3.7 The Contractor shall provide an air compressor to provide air at 100 psig for air scouring.

2.1.3.8 Filter backwash may be manual or automatic.

2.1.3.9 The filters shall be provided with a safety release valve or rupture disk designed to release at a pressure not to exceed 85 psig.

2.1.3.10 Pressure gages shall be provided for positive indication of inlet and outlet pressures.

2.1.3.11 Piping system shall include provision for sampling treated water stream before and after filtration.

2.1.3.12 Piping system shall provide low point drains.

2.1.4 Carbon Adsorbers:

2.1.4.1 The Contractor shall provide a pressure carbon adsorber system for removing PCBs from filtered water down to levels not exceeding one part per billion (ppb). The number of modules and filter arrangement is not specified.

2.1.4.2 The filters and carbon adsorbers must be arranged such that they fit on the existing concrete equipment pads.

2.1.4.3 Each adsorber module shall be of the same size and capacity. The filter effluent shall come together via a common header and then split into separate headers to each carbon adsorber. Back pressure orifice plates shall be used in each carbon adsorber to ensure approximately equal (within 15%) flows to each carbon adsorber module. The carbon adsorber contact time shall be sufficient to produce the specified quality of effluent but the contact time shall be no less than 15 minutes at 1500 gpm total flow. At least one spare carbon adsorber module shall be provided, which can be put into service in case the carbon needs to be changed during service or as a safety factor if the carbon contact time should be increased.

2.1.4.4 The Contractor is responsible for replacing the carbon if this should be required during operation. The following may be used as a preliminary order of magnitude estimate as to whether carbon replacement may be necessary:

PCB Concentration in Feedwater: 100 parts per billion (ppb)
Quantity of water treated: 225 million gallons
There may be other soluble organic materials in the water as a result of dredging which may be removed by the carbon with some decrease in capacity for PCB.

Actual PCB concentrations and water quantities may be different and will probably be less than the estimate given.

2.1.4.5 Granular activated carbon meeting the following specifications shall be used:

Iodine Number (mg/g)	850 minimum
Abrasion Number	70 minimum
Moisture, as packed:	2% maximum
Particle Sizes (U.S. Sieve Series)	8 x 30
Oversize:	15% maximum
Undersize:	4% minimum
Mean Particle:	1.4 to 1.7 mm

2.1.4.6 The Contractor need not provide backwash capability for the carbon adsorber system as the carbon would be disposed after its capacity is used up and feed water suspended solids should be low. Then piping associated with carbon adsorber backwash shown on the Drawings can be omitted. However, the granular carbon must be slurried into the adsorption well during loading and not be added dry to avoid channeling during operation. If the granular carbon is to be added to the vessel dry, backwashing capability must be provided in order to fluidize and wash the carbon before the system is placed in service. If backwashing is to be done, enough vessel freeboard must be provided to expand the carbon bed 100 percent. Backwash water shall be returned to the lagoon or sedimentation basin as controlled by valves shown on the Drawings. Backwashing may be manual.

2.1.4.7 Pressure gages shall be provided for positive indication of inlet and outlet pressures.

2.1.4.8 Piping system shall include provision for sampling treated water stream before and after the columns.

2.1.4.9 Piping system shall provide low point drains.

2.2 Equipment for the 200 GPM Water Treatment System:

2.2.1 Description:

2.2.1.1 Requirements:

(1) The Contractor shall provide the 200 GPM water treatment system shown on the Drawings, including but not limited to filter(s), carbon adsorber(s), monitoring equipment, building, and all piping, fittings, valves and control elements necessary to operate the filters and carbon adsorbers. The building shall provide "protection from the elements", have adequate heat for freeze protection and adequate lighting for servicing the equipment. The 200 GPM water treatment system will use the same sedimentation basin and clear well as the 1500 GPM system.

(2) The Contractor shall place the 200 GPM filter(s) and carbon adsorber(s) within the building to protect against freezing. This 200 GPM system is to be used to treat rainwater which accumulates in the lagoon after dredging is completed and to assist removal of excess water while the contaminated sediments are being removed from the lagoon. Removal of sediments from the lagoon will be done by others.

2.2.1.2 Options:

(1) The Contractor may elect to install a larger system than 200 GPM, but the equipment must fit inside a building and the pumps and piping must be sized accordingly. This may give the Contractor the option of using one of the modules making up the 1500 GPM system for the 200 GPM system. All new carbon shall be provided for this equipment.

(2) The Contractor may elect to keep some of the modules making up the 1500 GPM system on the same pads to be used for the 200 GPM system, and build the building around the pads. The 200 GPM system sand filter(s) and carbon column(s) must be protected against freezing in either case and the pumps must be sized to be compatible with the equipment.

2.2.2 Filters:

2.2.2.1 The Contractor shall provide a pressure filter system for removing suspended solids from polymer-treated water prior to carbon adsorption.

2.2.2.2 At least two filters should be provided so that a 200 GPM flow can be delivered to the carbon adsorber(s) when one filter is being backwashed. Each filter shall be of the same size and capacity.

2.2.2.3 Filtered water such as water from the clear well shall be used to backwash the filters. The backwash rate shall be consistent with the filter media used. Backwash water shall be returned either to the lagoon or sedimentation basin as controlled by valves shown on the Drawings. Filter backwash may be manual. At least one operating filter shall be supplying 200 gpm to the carbon absorber during backwash of the second filter if the system is operating on a 24-hour per day basis.

2.2.2.4 Air scouring shall be used during filter backwash. The Contractor shall provide an air compressor to supply air at 100 psig for air scouring.

2.2.2.5 The following feedwater characteristics shall be used when sizing the filters.

Suspended solids	10 to 50 ppm
Analysis of suspended solids	
Oil and grease	0.2 to 3%
Percent volatile solids	2 to 15%

Floating oil: either absent or present as a thin sheen on the water surface.

2.2.2.6 The filter effluent shall not exceed 2 ppm suspended solids when the filter feed water has been treated with 15 ppm of a suitable cationic polymer (such as Nalco 8103) followed by 1.5 hours or more in the sedimentation basin.

2.2.2.7 The filters shall be provided with a safety release valve or rupture disk designed to release at a pressure not to exceed 85 psig. ASME code vessels designed for 125 psig shall be used.

2.2.3 Carbon Adsorber(s)

2.2.3.1 The Contractor shall provide a pressure carbon adsorption system for removing PCBs from filtered water down to levels not to exceed one one part per billion (ppb) at 200 GPM flow rate.

2.2.3.2 Only one carbon adsorber need be provided. If more than one carbon adsorber is provided, each shall be of the same size and capacity. The carbon adsorber shall be sized such that the carbon contact time is sufficient to produce the specified quality of effluent but not less than 15 minutes in any operating adsorber.

2.2.3.3 If one or more carbon adsorber modules used in the 1500 GPM system is to be used for the 200 GPM, a fresh load of granular carbon must be used. The old carbon shall be placed in the lagoon.

2.2.3.4 The Contractor is responsible for replacing the carbon if this should be required during operation. The following may be used as a preliminary order of magnitude estimate as to whether carbon replacement may be necessary:

PCB Concentration: 100 ppb
Quantity of water to be treated:

1. Rainwater:
   Lagoon areas including dikes times the amount of precipitation which has fallen from the time the 1500 GPM system is removed to the time when removal of the lagoon sediments to landfill is complete

2. Sedimentation water from underdrains:
   Probably another 400,000 gallons

2.2.3.5 Granular activated carbon meeting the following specifications shall be used:

Iodine Number (mg/g):	850 minimum
Abrasion Number:	70 minimum
Moisture, as packed:	2% maximum
Particle Sizes (U.S. Sieve Series)	8 x 30
Oversize:	15% maximum
Undersize:	4% minimum
Mean Particle:	1.4 to 1.7 minimum

2.2.3.6 The Contractor shall provide a carbon adsorber with or without backwash capability.

(1) If the adsorber is furnished with the backwash capability the granular carbon may be added by use of a water slurry or may be added dry. If added dry, enough vessel freeboard shall be provided to allow the carbon bed to be expanded 100 percent.

(2) If the adsorber is furnished without backwash capability, the granular carbon shall be added by use of a water slurry.

2.2.4 Building to House 200 GPM System Components:

2.2.4.1 The building required for protection of the 200 GPM components is not shown on the Drawings. The Contractor shall submit shop drawings, to the USEPA OSC, which contain details and dimensions of materials to be used, erection details and dimensions and siting details. The materials used shall be masonry and metal, or metal only. Wood shall not be used as a building material!

2.2.4.2 Foundation:

2.2.4.2.1 Shop drawings showing details and dimensions of the proposed building foundation shall be submitted to the USEPA OSC. The floor shall be curbed to contain water resulting from a ruptured vessel and shall contain a sump equipped with a sump pump piped to the sedimentation basin.

2.2.4.2.2 If the Contractor elects to use an equipment pad(s) as the building foundation, shop drawings showing placement and anchorage details shall be submitted to the USEPA OSC.

2.2.4.3 Shop drawings showing details of the heating and lighting shall also be submitted.

2.3 Pump Design Basis:

2.3.1 The pumps specified in Section 15300: SPECIAL PIPING SYSTEMS AND EQUIPMENT are sized around Calgon Corp. filters and carbon adsorbers. The Calgon filters for the 1500 GPM system consists of four free-standing tanks each 10 feet in diameter, rated at 750 gpm, and requiring 750 gpm of backwash water with air scour (210 scfm at 100 psig). The maximum pressure drop across the 1500 GPM Calgon filter and carbon adsorbers is 65 psig. The Calgon adsorbers consist of 8 tanks each 10 feet in diameter including two spares (only one spare need be provided) with each tank rated at 250 gpm.

2.3.2 If other vendor systems are selected, the Contractor is responsible for checking backwash water requirements and pressure drops and for making any required changes in pump characteristics.

2.4 Valves:

2.4.1 Each filter for the 1500 GPM and 200 GPM systems shall be supplied with the necessary valves to permit backwashing of that filter while other filters remain on line. Each filter and carbon adsorber shall be supplied with cutoff valves on the inlet and exit side to permit the module to be taken out of service while flow passes through the other modules. If the carbon adsorber is to be backwashed, the adsorber must be supplied with the necessary valves to permit backwashing.

2.4.2 A valve shall be provided and installed in the effluent header pipe at a point immediately downstream of the filter outlets. Another valve shall be provided and installed in the effluent header pipe at a point downstream of the carbon adsorber outlets and upstream of the lagoon/Clear Well valve in the effluent pipe. These valves will be used for sampling the effluent from the filters and adsorbers.

2.5 Instrumentation and Controls: The Contractor shall supply and install the instrumentation and controls required for operation of the equipment being supplied under this Section. Such controls shall be compatible with the system described in Section 15900: INSTRUMENTATION AND CONTROLS.

3. EXECUTION:

3.1 1500 gpm Water Treatment System:

3.1.1 A process flow diagram for this system is shown on the Drawings. This system will be processing water on a 24 hour per day - seven day per week basis during the dredging of Upper Waukegan Harbor.

3.1.2 Equipment and materials, provided and installed under this Section, shall be checked and tested as a part of the 1500 gpm system specified in Section 01850: MAINTENANCE AND OPERATIONS.

3.1.2.1 Dry Checkout:

(1) Vessels, piping, valves, and controls shall be thoroughly inspected for proper fit, tightness, and visible defects.

(2) Any misalignment of piping or other deficiency found during the inspection shall be corrected.

3.1.2.2 Hydraulic Checkout:

(1) Vessels, piping, valves, and controls shall be checked for leakage.

(2) Each filter shall be backwashed.

(3) Leaks in the equipment shall be repaired or if directed by the USEPA OSC, the faulty equipment shall be replaced.

3.1.2.3 Demonstration Test:

(1) Prior to the effluent from the carbon adsorbers being discharged into the clear well, samples taken from the effluent pipe shall be tested in accordance with Section 01400: TESTING LABORATORY SERVICES. When the results of these tests show that the effluent meets the requirements set out in Section 01850: MAINTENANCE AND OPERATIONS, the USEPA OSC may direct that the effluent be discharged to the clear well.

(2) Should test results show that the effluent fails to meet the requirements, the treatment equipment and materials shall be adjusted as needed to produce an effluent which shall meet the requirements.

3.1.2.4 Materials and equipment required to produce acceptable effluent shall be supplied throughout the period of time that this 1500 gpm system remains in operation.

3.2 Major maintenance of all equipment supplied in accordance with this Section shall be performed as part of the work of this Section.

3.3 200 gpm Water Treatment System:

3.3.1 A process flow diagram for this system is shown on the Drawings. This system will be operated intermittently for the following purposes:

3.3.1.1 To treat rain water or snow melt that accumulates in the lagoon.

3.3.1.2 To treat water that accumulates in the lagoon underdrain and leachate systems while sediments are stored.

3.3.1.3 To treat all water encountered in the lagoon underdrain system during removal of contaminated sediments.

3.3.1.4 To treat water as directed by the USEPA OSC.

3.3.2 Equipment and materials, provided and installed under this Section, shall be checked and tested as a part of the 200 gpm system specified in Section 01850: MAINTENANCE AND OPERATIONS.

3.3.2.1 Dry Checkout:

(1) Vessels, piping, valves, and controls shall be thoroughly inspected for proper fit, tightness, and visible defects.

(2) Any misalignment of piping or other deficiency found during the inspection shall be corrected.

3.3.2.2 Hydraulic Checkout:

(1) Vessels, piping, valves, and controls shall be checked for leakage. The water to be used in this checkout will be potable water as described in Section 01850: MAINTENANCE AND OPERATIONS.

(2) The carbon adsorber effluent will be used for backwashing the filter(s).

(3) Leaks in the equipment shall be repaired or, if directed by the USEPA OSC, the faulty equipment shall be replaced.

3.3.2.3 Demonstration Test for Initial Startup:

(1) Prior to the effluent from the carbon adsorbers being discharged into the clear well, samples taken from the effluent pipe shall be tested in accordance with Section 01400: TESTING LABORATORY SERVICES. When the results of these tests show that the effluent meets the requirements set out in Section 01850: MAINTENANCE AND OPERATIONS, the USEPA OSC may direct that the effluent be discharged to the clear well.

(2) Should test results show that the effluent fails to meet the requirements, the treatment equipment and materials shall be adjusted as needed to produce an effluent which shall meet the requirements.

3.3.2.4 Materials and equipment required to produce acceptable effluent shall be supplied throughout the period of time that this 200 gpm system remains in operation.

3.4 All equipment provided and installed in accordance with this Section shall be removed in accordance with the schedule developed for this Work, and in accordance with Section 01850: MAINTENANCE AND OPERATIONS and Section 01030: SPECIAL PROJECT PROCEDURES.

3.5 All spent granular carbon and all spent filter material may be placed in the lagoon or will be removed by others upon completion of removal of contaminated sediments from the lagoon.

DIVISION 15 - MECHANICAL

SECTION 15010
GENERAL PROVISIONS,
MECHANICAL WORK

1. GENERAL:

1.1 This Section covers the general arrangement of the mechanical systems and related items to complete the work as shown on the Drawings and as specified herein. All applicable provisions of the GENERAL PROVISIONS and the SUPPLEMENTARY CONDITIONS are hereby made a part of this Section.

1.2 All equipment, including piping, valves, pumps, instrumentation, chemical treatment equipment, and water treatment equipment, provided in accordance with these Specifications and Drawings shall remain the property of the Contractor. Ownership of equipment shall not be transferred to the Owner.

1.3 The Contractor shall familiarize himself with the work of all other trades, general type construction, and the relationship of his work to other Sections. He shall examine all working Drawings, Specifications and conditions affecting his work. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the Work and working conditions, verify all dimensions in the field, and advise the USEPA OSC of any discrepancy before performing the work.

1.4 The work shall include complete testing of all equipment and piping at the completion of the work and making any minor connection changes or adjustments necessary for the proper functioning of the system and equipment.

1.5 The Contractor shall perform all necessary temporary work during construction.

1.6 Work under this Section shall conform to all governing codes, ordinances, and regulations of the city, county and state.

1.7 The Contractor shall be responsible for all errors in fabrication, for the correct fitting, for installation, and for erection of the various mechanical systems as shown on the Drawings.

2. DRAWINGS AND SPECIFICATIONS:

2.1 Drawings for work under this Section are in part diagrammatic, intended to convey the scope of work and indicate the general arrangement of equipment, piping and the approximate size and location of equipment and outlets. The Contractor shall follow these Drawings in laying out his work and shall verify spaces in which his work will be installed, indicating to the USEPA OSC where any conflicts or overlapping of systems occur.

2.2 When job conditions require reasonable changes in indicated locations and arrangement, proposed departures shall be submitted to the USEPA OSC with detailed drawings for approval before any of the proposed work is commenced.

2.3 Because of the small scale of the Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the structural and finish conditions affecting all of his work and shall arrange such work accordingly, furnishing such fittings, pipe, valves, and accessories as may be required to make a functional installation.

2.4 The Drawings and Specifications shall be considered as cooperative. Work and material included in either, though not mentioned in both, shall be a part of the Work to be accomplished and shall be carried out completely in as thorough a manner as if covered by both.

3. EQUIPMENT DESIGN AND INSTALLATION:

3.1 The design, manufacture, testing and method of installation of all apparatus and materials furnished under the requirements of these Specifications shall conform to the applicable standard rules of the following. Where materials are not specifically referred to, but are required, they shall meet the requirements of the applicable code.

NEMA	-	National Electric Manufacturers Association
UL	-	Underwriter's Laboratories, Inc.
ASME	-	American Society of Mechanical Engineers
ASTM	-	American Society for Testing Materials
ASHRAE	-	American Society of Heating, Refrigeration and Air Conditioning Engineers
AWWA	-	American Water Works Association
AWS	-	American Welding Society
ANSI	-	American National Standards Institute
NEC	-	National Electric Code
AIEE	-	American Institute of Electrical Engineers

3.2 Unless otherwise specified, equipment and materials of the same type and used for the same purpose, shall be products of the same manufacturer.

4. CAPACITIES AND OPERATING CONDITIONS:

Capacities, sizes and conditions specified or shown on the Drawings shall be regarded as minimum allowable. If the Contractor proposes to furnish any equipment which would have to operate at other than specified conditions to produce final effects, all other directly or indirectly related components of the entire system (as well as of the structure, finish, and other systems) must be properly coordinated to the satisfaction of the USEPA OSC. That is: Operating conditions through the entire system must be such that no motor is overloaded, no equipment operated noisier, faster, or hotter than manufacturer's publication recommends, and that no excess strain or demand is imposed on any component of any system or the structure; also that no quality, architectural feature, function or "end result" is affected adversely, in the opinion of the USEPA OSC.

5. LAYOUT:

5.1 The Contractor's work lines and established heights shall be in strict accordance with Drawings and Specifications insofar as these Drawings and Specifications extend. The Contractor shall verify all dimensions shown and establish all elevations and detail dimensions not shown. He shall also correlate his time so that the Work will proceed to the best advantage of the complete job as a unit. The Contractor shall be responsible for furnishing in ample time any information required to provide clearance which may be required to accommodate the work.

5.2 The Contractor shall layout his work well enough in advance to foresee any conflicts or interferences with work of other Sections so that in case of interference his layout may be altered to suit the conditions, prior to the installation of any work. This procedure will require constant coordination with all sections of the Work.

6. CUTTING AND PATCHING:

6.1 All cutting and patching required in connection with the installation of this work due to errors, defective work, ill-timed work or tardiness in properly designating size and location in sufficient time or by failure to notify other trades, shall be done under this Section, but only in the manner directed by the USEPA OSC so as to prevent or minimize damage to installed work. Damage as a result of cutting for installation shall be repaired by mechanics skilled in the trade involved, at no additional expense to the Owner.

6.2 No cutting of structural members will be permitted, except when prior written permission of the USEPA OSC has been obtained. This work must conform in every respect to the surrounding finish and to the quality of workmanship and materials used.

6.3 Piercing of any waterproofing shall be done only by the trade involved. After the part piercing the waterproofing has been set in place, the opening made for this purpose shall be filled and made absolutely watertight to the satisfaction of the USEPA OSC.

7. TESTS - GENERAL:

7.1 All tests required to establish the adequacy, quality, safety, completed status and suitable operation of each system and all components thereof shall be made in the presence of, and to the satisfaction of, the USEPA OSC and any other representative of State and local Government required to properly validate the tests. All instruments, labor, utilities, fuel and expert service necessary to conduct these tests shall be supplied by the Contractor.

7.2 Owner Furnished Equipment: No equipment shall be furnished by Owner.

7.3 The final inspection and tests are to be made only after the USEPA OSC is satisfied that the work described in these Specifications has been completely installed in accordance with the true spirit and intent of these Specifications and that complete preliminary tests were made which indicate adequacy, quality, completion and satisfactory operation. The acceptance of the work herein specified, shall not in any way prejudice the USEPA OSC's right to demand replacement of defective material and/or workmanship.

8. ELECTRIC MOTORS:

8.1 All motors shall be designed, tested and applied in accordance with the applicable standards listed hereinbefore. Motors shall be of sufficient size for the duty to be performed and shall not exceed the full load rating when the driven equipment is operating at specified capacity. Unless otherwise specified, all motors shall be TEFC type, and continuous-duty classification based on 40 degrees C. ambient temperature. Polyphase motors shall be squirrel-cage type, having normal-starting-torque and low-starting-current characteristics. When motor horse powers required differ from those indicated on the Drawings, the Contractor shall make the necessary adjustments to the wiring, disconnect devices, starters, and branch-circuit protection.

8.2 Motors shall be rated for continuous duty capable of driving the connected loads without exceeding temperature limitations of the motor insulation. Special Class B moisture-resisting insulation (designed to operate in a 40 degree C. ambient without exceeding a temperature rise rating designated by NEMA for the type of enclosure used) shall be utilized in each motor.

9. PERMITS AND INSPECTION:

The Contractor shall secure and pay for all permits, licenses, insurance and inspections required for the execution of the Work and deliver to the USEPA OSC all certificates related to, and issued by the authorities having jurisdiction. All equipment and systems shall be installed in strict compliance with all State and Local Codes. See Section 00800: SUPPLEMENTARY CONDITIONS for permits that are to be obtained by the Owner.

10. AS-BUILT DRAWINGS:

10.1 The Contractor shall deliver to the USEPA OSC at the completion of the installation, one (1) print of "As-Built" drawings, showing legibly and accurately, piping systems with equipment locations shown as actually installed. Changes in original Drawings shall be neatly shown in red pencil. Each print shall be signed by the Contractor.

10.2 During construction the Contractor shall retain a set of blue line drawings on the site for recording all changes. These drawings shall be available for inspection by the USEPA OSC.

11. FINAL TEST, OPERATION AND ACCEPTANCE:

11.1 In addition to any other testing specified, the Contractor shall perform the following tests and place the systems in operation to demonstrate

that all features of the systems including instrumentation, controls and automation function as specified, for final acceptance.

11.1.1 At such time as the USEPA OSC determines that each system is ready to be placed into service, the Contractor shall place the system in operation and demonstrate that all safety devices are in proper working order to the satisfaction of the USEPA OSC and as instructed by the manufacturer.

11.1.2 Depending on the status of the work, the Contractor may at his option conduct other required tests concurrent with, prior to, or following system testing, providing the USEPA OSC is satisfied that the installation is in conformance with the Specifications. However, all features of the systems shall be tested individually for proper operation at partial and full load conditions, and collectively where normal operations require the several components to operate concurrently to constitute an acceptable system.

11.2 Where a specific test period is not stipulated the equipment shall operate at full load until normal operating temperatures are reached and continue to operate for a minimum of one hour at full load to confirm that the equipment conforms to all Specification requirements such as capacity, overload, overheating, vibration, noise, etc.

11.3 Where ambient conditions preclude attaining full load in normal operation, the Contractor shall provide induced conditions which will allow achieving full load.

11.4 Operational tests to be conducted shall include but are not limited to the following systems:

a. Pump Controls and Interlocks
b. Chemical Feed System
c. Turbidity Measurement
d. Water Treatment System
e. Pumping and Piping Systems

11.5 Final acceptance of the entire installation will be based on an acceptable demonstration that all components, local and remote, respond to both manual and automatic system controls. During this test the Contractor shall cause simulated perturbations for which the automation and control systems are designed to respond. All control, monitor and readout points in the system shall function properly before final acceptance is made.

DIVISION 15 - MECHANICAL

SECTION 15050
BASIC MATERIALS
AND METHODS

1. GENERAL:

1.1 General Requirements: All equipment and materials shall be properly aligned, leveled, and adjusted for satisfactory operation. Equipment shall be installed so that the connecting and disconnecting of piping and accessories can be done readily and so that all parts are easily accessible for inspection, operation, maintenance and repair. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening and shall be serviced by organizations reasonably convenient to the site.

1.2 Approval of Materials and Equipment:

1.2.1 Within 30 days of receipt of notice to proceed, and before starting installation, the Contractor shall submit to the USEPA OSC for approval, in triplicate, layout drawings and lists of materials, fixtures, and equipment to be incorporated in the Work. The layout drawings shall consist of plans drawn to scale, with elevations and sections to show clearly the location and size of major items of equipment and large piping, and clearances for maintenance withdrawal of removable components. If departures from the Drawings are deemed necessary by the Contractor, details of such departures, including changes in related portions of the Work and the reasons therefor shall be submitted with the drawings. Where such departures require piping or equipment to be supported otherwise than shown, the details submitted shall include loadings and type and kinds of frames, brackets, stanchions, or other supports necessary. The lists of materials and equipment shall be supported by sufficient descriptive material, such as catalog cuts, diagrams, and other data published by the manufacturer, as well as evidence of compliance with safety and performance standards, to demonstrate conformance to the Specification requirements; catalog numbers alone will not be acceptable.

1.2.2 Shop Drawings: Shop drawings shall be submitted in accordance with the requirements of Section 01300: SUBMITTALS AND SUBSTITUTIONS.

1.3 Identification: Permanent and legible engraved tags, brass or laminated plastic, shall be installed on all switches, pumps, main valves, and controls, using the same nomenclature as appears on record drawings, diagrams and typewritten or printed operating instructions. A permanent index thereto shall be provided in triplicate, one copy of which shall be mounted under framed glass in the Operations Building. Each major component of equipment shall have the manufacturer's name, address and catalog number on a metal plate securely attached to the item of equipment. The nameplate shall be easily readable and not obscured during the period of construction by painting, or other work.

1.4 Prevention of Rust: Surfaces of ferrous metal shall be given a rust inhibiting coating as specified. Coal-tar or asphalt-type coating will not be acceptable unless so stated for a specific item. Where steel is specified to be hot dip galvanized after fabrication, mill galvanized sheet steel may be used, provided all raw edges are solvent-cleaned and primed with a galvanized metal primer such as "Galvanized Iron Primer" as manufactured by Sherwin-Williams, "Glid-Guard All Purpose Metal Primer No. 5229" as manufactured by Glidden, or approved equal.

1.5 Protection from Moving Parts: Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts located so that any person can come in close proximity thereto shall be fully enclosed or properly guarded.

1.6 Protection of Equipment and Materials:

1.6.1 After delivery, before and after installation, equipment and materials shall be protected against theft, injury, corrosion, contamination or damage from all causes.

2. MATERIALS:

2.1 General: Materials specified herein shall conform to the respective publications and other requirements specified in the following paragraphs and as shown on the Drawings. Other materials shall be the products of manufacturers regularly engaged in the manufacture of such products. Types, grades, schedules and pressure ratings for a particular service shall be as specified hereinafter and in other Sections of these Specifications.

2.2 Pipe:

2.2.1 Steel Pipe: ASTM Specification A 53 or A 106, Grade A or B, or A 120.

2.2.2 Polyvinyl Chloride (PVC) Piping: Pipe shall conform to ASTM D1785, Schedule 40; or to ASTM D2241, with SDR as necessary to provide 150 psi minimum pressure rating.

2.3 Fittings:

2.3.1 Steel Piping Welding Fittings: Steel buttwelding fittings conforming to ANSI Standard B 16.9 and ASTM Specification A 234. Long radius elbows shall be used wherever space permits. Buttwelding fittings shall be the same wall thickness and schedule as piping in which used. Forged steel socket-weld fittings, 3000 pounds, shall conform to ANSI Standard B 16.11 and ASTM Specification B 181, Grade 1.

2.3.2 PVC Piping Fittings: Fittings shall conform to ASTM D2464. Pipe and fittings shall be of the same PVC plastic material and shall be one

of the following pipe/fitting combinations, as marked on the pipe and fitting, respectively; PVC 1120/PVC I; PVC 1220/PVC II; PVC 2116/PVC II. Solvent cement for jointing shall conform to ASTM D2564.

2.3.3 Flanges: Class 150, ASTM Specification A 181, Grade I, dimensions in accordance with ANSI B 16.5; flat face against 150-pound and 250-pound cast iron flanges.

2.4 Pressure gauges shall be as specified under Section 15900: INSTRUMENTATION AND CONTROLS.

2.5 Valves:

2.5.1 For Process Water Service:

2.5.1.1 Plug Valves shall have steel or bronze bodies with resilient (neoprene) plug for tight shutoff, stainless steel bearings, flanged end connections, Buna filled TFE U-ring seals or Buna seals, and manual actuators. Valves shall be as manufactured by DeZurik, Series 100, Figure 118-F-1-RS16 or approved equal.

3. EXECUTION:

3.1 General: Pipe shall be cut accurately to measurements established at the jobsite and worked into place without springing or forcing. Cutting or other weakening of structure to facilitate piping installation will not be permitted without written approval. Layout drawings required under paragraph 1.2, Approval of Materials and Equipment shall show locations of all supports. Piping and equipment supports shall be as detailed on the drawings. Supports shall be attached only to structural framing members and concrete beams or slabs at approved locations with approved connections. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided and detailed. Pipes shall have burrs removed by reaming and shall be installed to permit free expansion and contraction without damage to joints or hangers. Changes in direction shall be made with fittings. All piping shall be installed with sufficient pitch to insure adequate drainage and venting. Piping connections to equipment shall be provided with unions or flanges.

3.2 Workmanship:

3.2.1 General: All materials and equipment shall be installed in accordance with the approved recommendations of the manufacturer to conform with the Drawings and Specifications. The installation shall be accomplished by workmen skilled in this type of work.

3.2.2 Welding and Brazing:

3.2.2.1 All welds shall be of sound metal thoroughly fused to the base metal at all points, free from cracks; and reasonably free from oxidation, blow holes, and non-metallic inclusions. No fins or weld metal

shall project within the pipe; and should they occur shall be removed. All pipe beveling shall be done by machine. The surface of all parts to be welded shall be thoroughly cleaned free from paint, oil, rust or scale, at the time of welding except that a light coat of oil may be used to preserve the beveled surfaces from rust.

3.2.2.2 All pipe and fittings shall be carefully aligned with adjacent parts and this alignment must be preserved in a rigid manner during the process of welding.

3.3 Flanges and Unions shall be faced true. Flanges shall be provided with a gasket suitable for the service and made square and tight. Union or flange joints shall be provided in each line immediately preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and other similar items. Gaskets shall conform to ANSI Standard B 16.21.

3.4 Valves in horizontal lines shall be installed with stems horizontal or above. Isolation valves shall be installed on each side of each piece of equipment such as pumps, and other similar items; and at any other points indicated or required for draining, isolation, or sectionalizing purposes.

3.5 Pipe Supports:

3.5.1 General: Pipe hangers, brackets, saddles, inserts, clamps, and pipe rolls including rods, bolts, turnbuckles, bases and protection shields shall be products of Grinnell, Fee & Mason, Piping Specialties, or approved equal. Chain, wire, strap, or other makeshift devices will not be permitted as hangers or supports. Hangers to support piping of 2 inches nominal size and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Hangers for piping shall be as indicated. Brackets for support of piping at walls shall be steel brackets. Beam clamps shall have malleable iron jaw, steel bolt or tie rod or nut. C-clamps will not be permitted unless a retainer is provided.

3.5.2 Horizontal Piping shall be supported by adjustable hangers or supports or as indicated on the Drawings. Unless otherwise indicated on the drawings, maximum spacing between pipe supports for straight runs of pipes shall be in accordance with the following schedule. Pipe hangers or supports shall be spaced not over 5 feet apart at heavy fittings and valves. A hanger shall be installed not over 1 foot from each change in direction of piping.

Nominal Pipe Size	Single Rod If Used, Diameter	Maximum Spacing	
		Ferrous Piping	PVC Piping
3/4" & Under	3/8"	6'	4'
1"	3/8"	7'	4-1/2'
1/4"	3/8"	8'	5'

1-1/2" & 2"	3/8"	9'	5'
2-1/2" & 3"	1/2"	12'	6'
4" & 5"	5/8"	14'	6-1/2'
6"	3/4"	14'	7-1/2'
8"	7/8"	14'	8'

Additional steel members, other than that shown on the Drawings, which may be required for maintaining pipe support spacing, shall be furnished and installed by the Contractor.

3.5.3 Vertical Piping shall be supported in the center of each riser but not over 15 feet on centers and shall be supported at the base of the riser on a base elbow or tee with pipe stand where shown on Drawings.

3.6 Tests:

3.6.1 General: All tests shall be conducted in the presence of the USEPA OSC who shall be given 7 days notice before any test is to be conducted. Any utilities, materials, equipment, instruments, and personnel required for the tests shall be provided by the Contractor.

3.6.2 Piping: After cleaning, all process piping shall be hydrostatically tested at a pressure equal to 150 percent of the total system operating pressure but not less than 100 psi for a period of time sufficient to inspect every joint in the system and in no case less than 2 hours. No loss of pressure will be allowed. Leaks found during tests shall be repaired by rewelding or replacing pipe or fittings. Caulking or peening of joints or fittings will not be permitted.

3.6.3 Pump Controllers: Automatic pump control operation from displacer switches per Section 15900: INSTRUMENTATION AND CONTROLS shall be fully demonstrated.

3.6.4 Turbidimeters: Operation of the turbidimeter shall be fully demonstrated.

3.7 Cleaning:

3.7.1 General: Clean all piping and equipment systems as required to leave the piping and equipment clean and free from scale, silt, contamination, etc. Process piping and equipment shall be so cleaned prior to use in processing PCB contaminated water and sediment. Also see Section 01030: SPECIAL PROJECT PROCEDURES.

3.8 Painting: Steel piping, fittings, and welds shall be coated with one coat of zinc-chromate primer, such as "Zinc Chromate Primer" as manufactured by Sherwin-Williams, "Glid-Guard Zinc Chromate Primer No. 5533" as manufactured by Glidden, or approved equal.

Specification Section No. 15050

SECTION 15050
BASIC MATERIALS
AND METHODS

In accordance with the requirements of the General Conditions and Supplementary General Conditions, the following information is required of the Contractor.

ITEM OR DESCRIPTION	SHOP DRAWINGS	CATALOG DATA	PARTS LIST	OPERATING MANUAL	WIRING DIAGRAM	CERTIFICATION	SAMPLES	OTHER
Layout Drawings	X							
Valves		X						
Hangers and Accessories		X						
Inserts and Clamps		X						

DIVISION 15 - MECHANICAL

SECTION 15300
SPECIAL PIPING
SYSTEMS
AND EQUIPMENT

1. GENERAL:

1.1 This Section includes special piping systems and equipment consisting of:

Chemical Feed System
Dredge Piping System
Process Piping System

1.2 The general arrangement of the equipment shall be as indicated on the Drawings. Details of departures, if any, shall be submitted to the USEPA OSC for approval. Capacity of the equipment shall be not less than those specified or indicated. The requirements of Section 15010: GENERAL PROVISIONS, MECHANICAL WORK and Section 15050: BASIC MATERIALS AND METHODS shall form a part of this Section.

2. CHEMICAL FEED SYSTEM:

2.1 The Chemical Feed System shall consist of a packaged chemical feeder with tank and adjustable pump and all piping required to add a polymer (such as Nalco 8103) to the sedimentation basin as lagoon water is being added.

2.2 Chemical Feeder: The chemical feed system shall be a completely pre-assembled packaged system with polyethylene tank, agitator, simplex pump, steel support stand, and suction piping with strainer. All materials of construction shall be compatible with polymer feed chemical.

2.2.1 Tank: Tank shall be nominal 100 gallon capacity and fabricated from polyethylene. Hinged cover shall be provided.

2.2.2 Pump: Pump shall be simplex with maximum capacity as indicated on the Drawings. Pump output shall be adjustable with not less than a 10 to 1 turn-down ratio. Adjustment shall be micrometer type dial.

2.2.3 Agitator: The agitator shall be sized to thoroughly mix contents of the tank. Shaft and propeller shall be stainless steel and operate at nominal 1725 rpm. Clamp shall be provided for mounting agitator to tank.

2.2.4 Electrical: Pump and agitator shall operate from 115 volt/3 phase/60 Hertz power supply.

2.2.5 Support Stand: A steel support stand shall be provided to support the chemical feed system equipment. Stand shall have manufacturer's standard painted finish. Stand configuration shall be for either side mounted or bottom mounted pump.

2.2.6 Manufacturer: Chemical Feed System shall be as manufactured by Neptune Chemical Pump Co., Model SM 100 PT, with 525-S-N1 pump and A-1.0 agitator, comparable Mogul, or approved equal.

2.3 Controls: The chemical feed pump shall be controlled as specified in Section 15900: INSTRUMENTATION AND CONTROLS and as shown on the Electrical Drawings.

2.4 Piping: The chemical feed system piping shall be poly-vinyl-chloride (PVC), of the size indicated on the Drawings. Joints shall be chemically welded type. Valves shall be PVC ball type.

3. DREDGE PIPING SYSTEM:

The dredge piping system shall consist of all piping, pipe supports, hose, and discharge float required to carry the dredged material slurry from the dredge to the discharge float in the lagoon. Materials of construction and pipe sizes shall be determined by the Contractor.

3.1 Routing: Dredge piping shall be routed as shown on the Drawings.

3.2 Discharge Float: The dredged material slurry shall be discharged into the lagoon from a floated discharge to prevent erosion of the clay liner. Float shall be located by two or more lines to shore of the lagoon. Lines shall be of sufficient length to allow the floating discharge to be moved as required for even deposit of the dredged material.

3.3 Leakage: Absolutely no leakage of the dredge piping can be allowed. The piping shall be tested for leakage in accordance with Section 15050: BASIC MATERIALS AND METHODS and each joint inspected. Dredge piping shall not be put into service until leakage test is complete and installation accepted by the USEPA OSC.

3.4 Materials of Construction: The materials of construction of the dredge piping system shall be selected by the Contractor. Number of joints should be minimized to reduce opportunity for leakage. Hose connecting the dredge to the piping on the shore shall be one-piece - without joints. No threaded joints shall be permitted in the dredge piping system.

4. PROCESS PIPING SYSTEM:

The process piping system shall consist of all pumps, piping, and accessories required to transport the contaminated water from the lagoon to the sedimentation basin, to the sand filter/carbon column water treatment system, and to the clear well as shown on the Drawings, for normal system operation. The process piping system also includes the pumps, piping and accessories associated with the leachate, underdrain, equipment pad sumps, and any other piping and equipment used for contaminated water.

4.1 Controls and Instrumentation: The sequence of control, and instrumentation shall be as specified in Section 15900: INSTRUMENTATION AND CONTROLS and as shown on the Electrical Drawings.

4.2 Pumps: Pumps shall be provided as specified below and as shown on the Drawings.

4.2.1 Vertical Centrifugal Sump Pumps:

4.2.1.1 Capacity: The vertical centrifugal sump pumps shall have capacities not less than those shown on the Drawings.

4.2.1.2 Base Plate (Pit Cover): Pumps shall be installed on a rigid, steel base plate which covers the pit pump opening and is securely fastened to the opening. The steel base plates shall be 1/2 inch minimum thickness.

4.2.1.3 Service: Pumps shall be specifically designed for contaminated harbor water containing silt, dirt, and sand, at ambient temperatures.

4.2.1.4 Materials of Construction: The pumps shall have a cast iron case, bronze impeller, steel shaft, and rubber, product lubricated steady bearings.

4.2.1.5 Pit Depth: Pumps shall be designed for the pit depths indicated on the Drawings. "Tail Pieces" shall be provided as required to bring pump intake to approximately 6 inches from the bottom of the pit. Intake shall not be closer to bottom of pit than as recommended by the pump manufacturer.

4.2.1.6 Electrical: Electrical drive motor horsepower shall be adequate to deliver flows and discharge pressure capacities as indicated on the Drawings and be non-overloading at near zero discharge pressure. Motors shall be 460 volt/3 phase/60 Hertz, 1750 rpm, totally enclosed fan cooled type suitable for outdoor installation. Starters shall be provided under Section 16155: MOTOR CONTROLS.

4.2.1.7 Steady Bearings: Steady bearings shall be provided for indicated pit depths/shaft lengths as recommended by the manufacturer. Bearings shall be product lubricated.

4.2.1.8 Controls: Pump start and stop controls shall be as specified in Section 15900: INSTRUMENTATION AND CONTROLS.

4.2.1.9 Manufacturer: Pumps shall be as manufactured by Gould Pumps, Inc., Model 3171, comparable Aurora pump, or approved equal.

4.2.2 Submersible Sump Pumps:

4.2.2.1 Capacity: The submersible sump pumps shall have capacities not less than those shown on the Drawings.

4.2.2.2 Service: Pumps shall be specifically designed for contaminated harbor water containing silt, dirt, sand, and carbon granules from carbon columns at ambient temperatures.

4.2.2.3 Materials of Construction: The pump body shall be cast iron, with stainless steel shaft.

4.2.2.4 Pit Depth: Pump shall be designed for submerged operation in pit depth as shown on the Drawings.

4.2.2.5 Electrical: Electric drive motor horsepower shall be adequate to deliver flow and discharge pressure capacity as indicated on the Drawings, and be non overloading at near zero discharge pressure. Motors shall be 460 volt/3 phase/60 Hertz/ 3450 rpm, and submerged in oil within the pump casing. Starters shall be provided under Section 16155: MOTOR CONTROLS.

4.2.2.6 Controls: A level control switch shall be provided to start and stop the pump. Switch shall have a differential of approximately 6 inches.

4.2.2.7 Manufacturer: Pumps shall be as manufactured by Gould Pumps, Inc., Model WP 3881, comparable PACO, or approved equal.

4.2.3 Vertical Industrial Turbine Pumps:

4.2.3.1 Capacity: The vertical industrial turbine pumps shall have capacities not less than those shown on the Drawings.

4.2.3.2 Base Plate (Pit Cover): Pumps shall be installed on a rigid, steel base plate which covers the pit opening and is securely fastened to the opening. The steel base plates shall be 1/2 inch minimum thickness.

4.2.3.3 Service: Pumps shall be specifically designed for contaminated harbor water containing silt, dirt, and sand, at ambient temperatures.

4.2.3.4 Materials of Construction: Discharge head shall be cast iron or fabricated steel with 150 pound raised face ANSI discharge flange, bowl shall be cast iron, impeller of bronze, bowl bearing of bronze, bowl shaft of 416 SS, strainer of galvanized steel, column of steel, column bearings of rubber, and column shaft of 416 SS.

4.2.3.5 Pit Depth: Pumps shall be designed for the pit depth as indicated on the Drawings. Intakes shall be approximately 6 inches above the bottom of the pit. Intake shall be not closer to bottom of pit than as recommended by the manufacturer.

4.2.3.6 Electrical: Electrical drive motor horsepower shall be adequate to deliver flows and discharge pressure capacities as indicated on the Drawings and be non-overloading at near zero discharge pressure. Motors shall be 460 volt/3 phase/60 Hertz, 1750 rpm, totally enclosed fan cooled type suitable for outdoor installation. Starters shall be provided under Section 16155: MOTOR CONTROLS.

4.2.3.7 Column Bearings: Rubber product lubricated column bearings shall be provided for indicated pit depths as recommended by the manufacturer.

4.2.3.8 Controls: Pump start and stop controls shall be as specified in Section 15900: INSTRUMENTATION AND CONTROLS.

4.2.3.9 Manufacturer: Pump shall be as manufactured by Gould Pumps, Inc. Model VIT, comparable Verti-Line pump, or approved equal.

4.3 Piping: Process piping shall be installed and routed as shown on the Drawings.

4.3.1 Materials of Construction: The pipe shall be A53, Schedule 40, carbon steel as specified in Section 15050: BASIC MATERIALS AND METHODS. All process pipe joints shall be welded or flanged, regardless of pipe size. No threaded joints shall be permitted in the process piping system.

4.3.2 Pipe Supports: Pipe supports shall be as specified in Section 15050: BASIC MATERIALS AND METHODS and as indicated on the Drawings.

4.3.3 Leakage: Absolutely no leakage of the process piping can be allowed. The piping shall be tested in accordance with Section 15050: BASIC MATERIALS AND METHODS and each joint inspected. Process piping shall not be put into service until leakage test is complete and installation accepted by the USEPA OSC.

4.3.4 Valves: All valves used in the process piping system shall be eccentric plug type as specified in Section 15050: BASIC MATERIALS AND METHODS. Valves must be capable of tight shutoff with process water containing suspended solid material of silt and sand as would be found in the Harbor water.

4.3.5 Low Point Drains: All process piping shall be provided with one inch, valved low point drains.

4.4 Miscellaneous Systems: Any other systems required by the Contractor's installation but not specified herein shall be provided, such as compressed air. These systems shall be provided and installed as required with approval of the USEPA OSC.

In accordance with the requirements of the General Conditions and Supplementary General Conditions, the following information is required of the Contractor.

ITEM OR DESCRIPTION	SHOP DRAWINGS	CATALOG DATA	PARTS LIST	OPERATING MANUAL	WIRING DIAGRAM	CERTIFICATION	SAMPLES	OTHER
Chemical Feeder		X						
Dredge Discharge Float	X							
Valves		X						
Pumps		X						
Piping Systems Layouts	X							

DIVISION 15 - MECHANICAL

SECTION 15900
INSTRUMENTATION
AND CONTROLS

1. GENERAL:

1.1 Related Specification: The requirements of Section 15010: GENERAL PROVISIONS, MECHANICAL WORK shall form a part of this Section of the Specifications.

1.2 Requirements:

1.2.1 Instrumentation and controls shall be standard, commercially available items.

1.2.2 All instrumentation and controls shall be new, and products of manufacturers regularly engaged in the manufacture of such products.

1.2.3 Equipment shall be of types that have been in satisfactory service under normal field operating conditions for not less than 2 years prior to the award of the contract.

1.2.4 Where two or more units of the same type of equipment are required, they shall be the products of a single manufacturer.

1.2.5 A complete and accurate control schematic with sequence of operation shall be mounted "under glass" in the Operations Building.

1.2.6 All instruments shall be clearly labeled as to specific function and keyed to the control schematic provided by the Contractor.

1.3 Control System:

1.3.1 General: This Section defines the instrumentation and controls for safe, convenient, and efficient operation of the equipment. The Contractor shall provide and install all materials and equipment required for a complete system even if not specifically called for in this Section.

1.3.2 Electrical Work - Controls: All wiring associated with the control system shall be the responsibility of the the electrical subcontractor. Electrical equipment and wiring shall be in accordance with DIVISION 16: ELECTRICAL.

1.4 Sequence of Control: The instrumentation and controls systems shall accomplish the sequence of control as detailed below:

1.4.1 Lagoon Intake Structure Pumps: The lagoon intake structure pumps shall be controlled by Hand-Off-Automatic switches at the pumps, and On-Off switches in the Operations Building. With local switches in Auto posi-

tion, the individual pumps may be started or stopped by the On-Off switches in Operations Building provided water level is above minimum for safe pump operation and water level in the sedimentation basin is below maximum design level.

Displacer type level controllers, located in the intake structure and sedimentation basin shall provide switch contacts to interlock starting and stopping of these pumps. The lagoon pumps shall then continue to operate as long as the level controllers allow.

A manual balance valve is provided in the pump discharge headers to obtain a slightly higher flow rate into the sedimentation basin. This will prevent cycling at the sedimentation pumps and treatment system. If the lagoon intake structure pumps stop on low level, they shall restart atuomatically if the water level returns to a safe operating level, as determined by the intake structure displacer level controller. Restart level shall be placed high enough so that the pumps do not cycle on and off frequently.

1.4.2 Polymer Chemical Feed System: The polymer chemical feed system pump shall be controlled by a local Hand-Off-Automatic switch at the pump and an interlock with the lagoon intake structure pump operation. With the switch in Auto position the feed pump shall start and run whenever a lagoon pump is operating.

1.4.3 Sedimentation Basin Pumps: The sedimentation basin shall be controlled by Hand-Off-Automatic switches at the pumps and On-Off switches in the Operations Building. With local switches in the Auto position, the individual pumps may be started or stopped by the On-Off switches in the Operations Building provided water level is above minimum for safe pump operation.

If the sedimentation basin pumps stop on low level, they shall restart automatically if the water level returns to a safe operating level, as determined by the sedimentation basin displacer level controller. Restart level shall be placed high enough so that the pumps do not cycle on and off frequently.

1.4.4 Clear Well Pumps: Sequence of operation for the clear well pumps shall be the same as for the sedimentation basin pump.

1.4.5 Underdrain and Leachate Sump Pumps: The underdrain and leachate sump pumps are operated from local On-Off switches at the pumps. Level switches also stop the pumps automatically on low level and prevent pump starting unless adequate liquid is present in the sump.

2. MATERIALS:

2.1 Turbidimeters:

2.1.1 General: The turbidimeters shall be of the "continuous flow nephelometer" type which measure scattered sample light. Electrical com-

ponents shall be solid-state and isolated in a compartment sealed off from wetted parts. All equipment required for a complete operating system shall be provided. Two turbidimeters shall be provided. One meter shall monitor the sand filter discharge and shall first be installed on the 1,500 GPM system and then be reused on the 200 GPM system. The second meter shall monitor the clear well water.

2.1.2 Range: Turbidimeter shall have multiple ranges which are manually selected. Ranges shall be nominally 0 - 0.2, 0 - 1, 0 - 3, and 0 - 30 NTU.

2.1.3 Alarms: Unit shall have two alarm setpoints which shall be adjustable over the entire range of the instrument. Indicating lights shall be provided on face of instrument as well as 3A/115V resistive contacts. A loud horn shall be provided for each turbidimeter.

2.1.4 Sample Pump: Sample pump shall be provided with the instrument.

2.1.5 Bubble Trap: Bubble trap shall be provided with the instrument.

2.1.6 Electrical: Turbidimeter and sample pump shall operate from 115 volt/1 phase/60 Hertz power supply. All equipment shall be contained in a NEMA 4 enclosure with glass panel in door so that meter and alarm light status may be determined without opening the door.

2.1.7 Manufacturer: Turbidimeter shall be as manufactured by Hach Chemical Co., Model 1720A, Low Range Turbidimeter, with Model 15973-00 Sample Pump, and NEMA 4 enclosure, comparable Great Lakes Instruments, or approved equal.

2.2 Displacement Type Liquid Level Controls:

2.2.1 General - Lagoon Intake Pump Control: Control shall be of the single switch type for wide differential application. Lower displacer shall be located just above pump tail piece inlet to stop pump on low level. Upper displacer shall be located above the pump to prevent pump starting unless pump is flooded. In automatic mode pump(s) shall run if water level in intake structure is above the upper displacer (and sedimentation basin is not at high-high level to prevent overfilling).

2.2.2 General - Sedimentation Basin Pump Control: Control shall be of the three level(s) switch type for wide differential application. (Upper and lower switches only are used.) Lower displacer shall be located just above the pump inlet to stop pump on low level, second displacer from bottom shall be located above the pump to prevent pump starting unless pump is flooded. In automatic mode pump(s) shall start if water level is above the intermediate displacer. The upper two displacers are used to actuate/deactuate a high level interlock to prevent overfilling of the sedimentation basin by the lagoon pumps.

2.2.3 General - Clear Well Pump Control: Control shall be of the single switch type for wide differential application. Lower displacer shall be located just above the pump inlet to stop the pump on low level. Upper displacer shall be located just above the lower one to reset the switch and allow the pump(s) to be started with relatively low water level in the clear well.

2.2.4 General - Leachate and Underdrain Sump Control: Control shall be of the single switch type for wide differential application. Lower displacer shall be located just above the pump inlet to stop the pump, on low level. Upper displacer shall be located just above the pump inlet to stop the pump on low level. Upper displacer shall be located just above the lower one to reset the switch and allow the pump to be started with relatively low water level in the sump. Operation is the same in the leachate sump and the underdrain sump.

2.2.5 Switches: Switches shall be enclosed in a NEMA 4 enclosure. The switches shall be mercury type, SPDT, rated for not less than 7 amp full load at 115 V AC.

2.2.6 Displacers: Displacers shall be procelain and suspended from a stainless steel cable of adequate length to locate the displacers near the bottom of the vessels. Displacers and switch shall provide for minimum differential band of 6 inches. Displacers shall be enclosed in perforated pipe nominally 1 inch larger in diameter for their protection.

2.2.7 Manufacturer: The displacement type liquid level controls shall be as manufactured by Magnetrol International, Inc., Model A 103, comparable Mercoid, or approved equal. Lagoon intake pump controller shall be single switch type; sedimentation basin shall be three level stage (-3X), arrangement A using upper and lower switches; and the clear well, leachate sump, and underdrain sump shall be single switch type.

2.3 Pressure Gage:

2.3.1 General: Pressure gages shall be installed at all locations shown on the Drawings. Ranges shall be as indicated. Gages shall be 4-1/2 inch size, have 1 percent accuracy rating, and moulded case. All gages shall be installed with shutoff valve. Pump discharge gages shall have snubber/throttler to damp pulsations.

2.3.2 Manufacturer: Gages shall be as manufactured by Marshalltown, Figure No. 24, and Figure 129 throttler, comparable Ashcroft, or approved equal.

2.4 Control Panel: A pump control panel shall be provided which has On-Off switches for the lagoon intake structure, sedimentation basin, and clear well pumps. Pilot lights shall be provided to indicate pump operating status.

3. EXECUTION:

3.1 All materials and equipment shall be installed by workmen skilled in this type of work.

3.2 All instrumentation and controls shall be installed in accordance with the manufacturer's recommendations using appropriate tubing, connections, wiring, and supports or as detailed on the drawings. The instrumentation and controls shall be installed by competent technicians. Equipment, piping, tubing, and wiring shall fit into the space allotted and allow adequate, acceptable clearances for entry, servicing, and maintenance. Locally mounted instruments shall be installed in such a manner as to prevent interference with mechanical installation and to insure convenient readability from the aisles or operating areas. Installation of the instrumentation shall be carefully coordinated with the work of other trades.

3.3 The control panel shall be installed in the Operations Building.

Specification Section No. 15900

INSTRUMENTATION AND CONTROLS

In accordance with the requirements of the General Conditions and Supplementary General Conditions, the following information is required of the Contractor.

ITEM OR DESCRIPTION	SHOP DRAWINGS	CATALOG DATA	PARTS LIST	OPERATING MANUAL	WIRING DIAGRAM	CERTIFICATION	SAMPLES	OTHER
Turbidimeters		X						
Pressure Gages		X						
Level Controllers		X						

DIVISION 16 - ELECTRICAL

SECTION 16010
GENERAL PROVISIONS,
ELECTRICAL WORK

1. GENERAL:

1.1 The Contractor shall furnish all labor and materials necessary and shall install, complete and ready for use, the electric power, lighting systems, telephone conduit system, including the installation and wiring of miscellaneous instruments and devices, as indicated on the Drawings and as herein specified.

1.2 All electrical equipment and details of installation shall comply with the requirements of the latest revisions of the following codes and standards.

National Electrical Code (1981 edition)
National Electrical Safety Code (ANSI C2-1981)
Institute of Electrical and Electronic Engineers (IEEE) Standards
National Electrical Manufacturer's Association (NEMA) Standards
State and local codes

1.3 All materials and equipment installed shall be new and unused and shall be of the latest design of manufacturers regularly engaged in the manufacture of such products that conform with the requirements of the contract drawings and specifications.

1.4 The Drawings indicate the extent and general locations of equipment, conduit and wiring. The Contractor shall be responsible for changes required in the field to avoid interference with equipment and facilities. Any change shall be coordinated with the USEPA OSC before the change is made and, if approved, the Contractor shall be responsible for showing the change on the "As Built" drawings.

1.5 The Contract Documents have been produced with the intention of their yielding through construction, an electrical utility and instrumentation system that is fully operable, safe, complete and in full compliance with the latest editions of the National Electrical Code, local codes and ordinances, and any other authority having jurisdiction over the work. The omission of any miscellaneous electrical items or accessories not specifically called for in these Contract Documents which would detract from this intention shall not relieve the Contractor of the responsibility of furnishing and installing these items and accessories.

1.6 Scale dimensions as shown on the Drawings shall be considered as approximate. The Contractor shall be responsible for making field verifications. Specific attention shall be given to the exact location of any underground lines installed under this contract. These lines shall be dimensioned

to easily identifiable points on permanent building structures for location and elevation and these dimensions shall be entered and shown on the "As-Built" drawings.

2. AS-BUILT DRAWINGS: The Contractor shall obtain from the USEPA-OSC one (1) set of BLUE-LINE prints of the Drawings and these prints shall be kept and maintained in good condition at the project site. Where construction differs from the Drawings, a qualified representative of the Contractor shall, at the end of each working day, enter upon these prints the actual "as-built" record of any and all changes that have been made during that day's construction progress. Entries and notations shall be made in a neat and legible manner and these prints shall be delivered to the USEPA-OSC upon completion of the construction.

3. MISCELLANEOUS REQUIREMENTS:

3.1 Submissions of shop drawings and data pertaining specifically to electrical work shall be clearly marked to show only items applicable to this work.

3.1.1 Shop drawings for each required item shall contain manufacturer's drawings, bills of material, panel and equipment layouts, data, and information for each assembly submitted in one package insofar as possible. Partial submittals may be returned without action.

3.1.2 Bills of material shall include a numbered list of all components, with manufacturer's name, catalog number, rating, and other identification of each component. The item number or similar identification, shall appear on all drawings where the item appears. Where components of a major piece of equipment have been purchased by the equipment manufacturer for use in building the major equipment, the bill of material shall show the original manufacturer's name and his catalog number of the component part as well as any different part number assigned to it by the major equipment manufacturer.

3.1.3 Shop drawings required are contained in, but not necessarily limited to, the following list:

Motor Control Equipment
Panelboards
Lighting Fixtures (All types specified)
Wire and Cable
Conduit & Fittings
Wiring Devices

3.1.4 Early submission shall be made of certain drawings where dimensions of equipment, location of conduit entrances, etc., are important to facilitate construction.

3.1.5 Shop drawings shall include one-line diagrams, schematic diagrams and wiring diagrams. Other drawings, such as control sequence diagrams, relay diagrams, metering, etc. may also be needed. Each drawing shall be complete, showing all local and remote devices associated with each item.

3.1.6 The USEPA OSC reserves the right of approval or disapproval of equipment. Where the shop drawings representing equipment vary substantially from the intent of the Contract Documents, they will be rejected and resubmission called for. Where only slight differences are found, shop drawings will be marked to show required changes and marked "Approved as Noted" or such notation, returned, and fabrication may begin. NO EQUIPMENT WILL BE VERBALLY APPROVED AND APPROVAL OF EQUIPMENT PRIOR TO THE BID OPENING WILL NOT BE FORTHCOMING.

3.1.7 Time-current characteristic curves for all circuit breakers and fuses used in this work shall be submitted for approval.

3.1.8 When the USEPA OSC cannot make a proper determination from the submitted shop drawing as to whether an item meets the requirements, additional information may be sought or, in certain cases, a sample of the item in question requested. The Contractor shall provide the USEPA OSC with this information or sample as soon as possible after the request has been made so as not to deter construction progress. Samples will be returned as soon as the USEPA OSC has made his determination. The USEPA OSC reserves the right, however, to fully test the sample and to disassemble it if necessary to gain full information. While care will be taken not to damage the sample, no guarantee is made or implied that the sample will be in working order or even repairable when returned.

3.2 Upon completion of construction of this work, the Contractor shall prepare three (3) manuals which shall include the items mentioned above as well as the following:

3.2.1 A record copy of all shop drawings marked "approved" by the USEPA OSC and incorporating any changes requested at the time of shop drawing submittal.

3.2.2 Drawings, pictures, etc. showing each piece of equipment in detail and giving a complete description. Standard publications forming a part thereof shall be marked specifically for this Work. Any non-applicable items shall be crossed out, blanked out, or otherwise deleted.

3.2.3 A complete parts list for each piece of equipment giving the model number and manufacturer of each item in the manufacturer's parts list catalog.

3.2.4 Operating and maintenance instructions prepared by the manufacturer for each piece of equipment.

3.2.5 An operating section in which step-by-step procedures are given for operation of each major electrical system. This section shall contain drawings and diagrams as required for clarity and instruction. The USEPA OSC shall be instructed accordingly.

3.2.6 Equipment for which instructions are considered necessary shall include but not be limited to the following:

Motor Control Equipment
Control Panels

3.2.7 Each copy of the manual shall consist of a properly sized, hard back, loose-leaf filler into which the information has been properly inserted.

3.2.8 When completed, these manuals shall be submitted to the USEPA OSC for approval.

3.3 Identification Markers:

3.3.1 Machine-engraved, laminated plastic identification markers shall be provided throughout the project. Unless otherwise noted elsewhere in the Contract documents, letters shall be 1/2 inch and color shall be black letters on a white background. They shall be securely mounted on equipment by means of sheet metal screws, machine screws and nuts or pop rivets. Adhesive mounting will not be acceptable.

3.3.2 Motor starters shall have identification markers identifying by name the equipment driven by the motor controlled.

3.3.3 Each major component of equipment shall have the manufacturer's name, address, and catalog number on a metal plate securely attached to the item of equipment. The nameplate shall be easily readable and care shall be taken during the construction so as not to obscure the nameplate information with paint or other markings. Where applicable, this nameplate shall give information about the equipment as follows:

Rated voltage
Rated amperage
Ground bus ampere rating
Number of phases
Number of poles
Frequency
Horsepower where motor rated

3.3.4 Where the manufacturer's nameplate gives the rated voltage and the utilization voltage in the equipment is different (such as rated at 600 volts with utilization voltage at 480 volts), the machine engraved, plastic nameplate shall show the actual utilization voltage.

3.4 As soon as possible after the award of contract, the Contractor shall submit all information and data on the wires, cables, and other long delivery items he proposes to use. Early submission for review and early ordering, is required to avoid delays in completion of the Work.

4. GUARANTEE:

The Contractor shall refer to the article on Guarantees and Warranties in the General Conditions or Supplementary Conditions to determine the extent of his guarantee periods.

5. INTERFERENCE AND ERRONEOUS LOCATIONS:

5.1 The locations of electrical equipment, devices, outlets, and similar items, as indicated on the Drawings, are approximate only. Exact locations shall be as determined or accepted by the USEPA OSC during construction. Any substantial changes shall be as approved by the USEPA OSC and shown as a revision on the "as-built" drawings.

5.2 The Structural, Electrical and Mechanical Drawings and Specifications are complimentary to one another. It would behoove the Contractor to study closely ALL drawings and specifications as he will be responsible for furnishing labor and materials for rough-in through final connections of electrical service to any and all equipment requiring it whether furnished by the Contractor, or any of the subcontractors under any of the Contract Documents. The Contractor shall also be responsible for all damages caused by erroneously connected equipment.

5.3 The Contractor shall field verify the locations of any and all equipment requiring electrical service before rough-in work begins. If the actual location varies substantially from that shown on the Drawings, he shall contact the USEPA OSC immediately for further instructions.

5.4 The Contractor shall verify the total load to be placed on the circuits as well as voltage, phase and connections to equipment before rough-in and if they differ from the Drawings or Specifications, he shall contact the USEPA OSC immediately for further instructions before the work commences.

6. EQUIPMENT SPECIFIED ELSEWHERE:

6.1 Certain items of control and other equipment are indicated on the Electrical Drawings for connection, but are specified in other Sections pertaining to instrumentation; treatment process; etc. Such items are not furnished as part of the electrical work.

7. PROTECTION OF ELECTRICAL EQUIPMENT:

7.1 Electrical equipment shall be protected from the weather, especially from water dripping or splashing upon it, at all times during shipment, storage, and construction. Equipment shall not be stored outdoors even if it

is an enclosure rated as weatherproof, watertight, etc. Where equipment is installed or stored in moist areas, such as unheated buildings, etc., it shall be provided with an acceptable means to prevent moisture damage such as a uniformly distributed source of heat to prevent condensation.

8. DEFECTIVE OR DAMAGED EQUIPMENT:

8.1 Should it be determined by the Contractor, Owner, or USEPA OSC that any equipment or material has been subjected to possible damage by water, it shall be thoroughly dried and put through a dielectric test as directed by the manufacturer, at the expense of the Contractor or shall be replaced by the Contractor without additional charge. Any equipment found to be marginal or that fails to meet manufacturer's standards shall be replaced at no additional charge to the Owner.

8.2 Any equipment damaged during shipment, while stored, or during construction shall be replaced at the Contractor's expense. Minor scratches on equipment cabinets, etc. may be repaired on site. Any current carrying parts, switch blades, operators, coils, contacts, etc. which are damaged, shall be replaced at no cost to the Owner.

9. APPROVAL AND MARKING OF EQUIPMENT:

Electrical devices and materials shall be listed and/or labeled by the Underwriters' Laboratories, Inc., wherever standards have been established by that agency and the equipment shall bear the UL seal. Where Underwriters' Laboratories listing is not available for equipment, the Contractor shall submit certified test reports of an adequately equipped, recognized, independent testing laboratory, approved by the local inspecting authority, indicating that the equipment is in conformance with local code requirements or any other applicable requirements. In lieu of the independent test reports, written approval of the equipment by the local electrical inspecting authority will be acceptable. The Contractor shall bear the costs of tests necessary for approval of equipment.

10. PERMITS AND APPROVALS:

10.1 The Contractor shall obtain all permits necessary. See Section 00800: SUPPLEMENTARY CONDITIONS for permits that are to be obtained by the Owner.

10.2 The Contractor shall furnish inspection by an agency licensed to perform electrical inspections in the State of Illinois.

10.3 The Contractor shall notify the electrical inspector, in writing, immediately upon the start of the work and A COPY OF THE NOTICE SHALL BE SENT TO THE USEPA OSC.

10.4 Inspection shall be scheduled for rough as well as finish work. The rough inspection shall be divided into as many inspections as may become necessary to cover all roughing-in.

10.5 The Contractor shall furnish 2 copies of certificates of final approval by the electrical inspector to the USEPA OSC.

11. TESTS AND INSPECTION:

11.1 The Contractor shall provide all tests as specified herein and all additional tests necessary to establish the adequacy, quality, safety completed status and suitable operation of each system and components thereof. The final inspection will be made after the USEPA OSC is satisfied that the work has been completely installed and that complete preliminary tests were made which indicate the adequacy, quality, completion and satisfactory operation of the system.

11.2 All branch circuits of No. 8 wire and larger and main feeders shall be tested with a meg-ohmmeter for ground and insulation resistance before connections to equipment.

11.3 ALL MOTORS (1/2 HORSEPOWER AND LARGER) SHALL BE MEGGED BEFORE CONDUCTORS ARE CONNECTED THERETO AND AGAIN AFTER THEY HAVE GAINED RUNNING TEMPERATURE. RESISTANCE READINGS SHALL MEET OR EXCEED MANUFACTURER'S PUBLISHED DATA.

11.4 A RECORD OF ALL INSULATION RESISTANCE TESTS SHALL BE DELIVERED TO THE USEPA OSC BEFORE FINAL ACCEPTANCE. USEPA-OSC SHALL BE NOTIFIED IN ADVANCE SO THAT HE MAY BE GIVEN THE OPTION OF WITNESSING THE TEST.

12. REFERENCE TO OTHER CONTRACT DOCUMENTS:

12.1 The Contractor shall refer to the complete set of contract documents and shall base his bid on those requirements.

13. OR EQUAL CLAUSE:

13.1 The use of the manufacturer's names and catalog numbers used herein is to indicate minimum standards of quality and performance. Equipment of equal quality, rating, and performance may be submitted for approval in accordance with Section 01300: SUBMITTALS AND SUBSTITUTIONS. It shall be the sole responsibility of the Contractor to prove equality and if, as a result of substitution, any modifications are necessary to meet the quality and design criteria of the specified material and/or systems, the Contractor shall be responsible for those modifications with no additional charge to the Owner. Any necessary modifications shall be shown on the shop drawings submitted for approval.

14. CIRCUITRY:

14.1 All wiring on this project, except control wiring, shall reflect the phase relationship by using red, blue and black insulated wires for all ungrounded conductors. White shall be used for neutral and green or green

with two or more yellow stripes for equipment ground. No two wires of the same color shall be run in the same conduit except for control wiring, switch legs, neutral, ground, etc. Control wiring inside any compartment which may be energized from a source outside the compartment shall have yellow insulation. Where yellow insulated wires are used inside any cabinet, compartment, etc. a machine engraved, laminated plastic identification marker shall be installed on the outside of the compartment which reads:

CAUTION	(5/8" letters)
Wires inside may be energized from separate source.	(3/8" letters)

Marker shall be white letters on a red background.

15. CONTRACTOR"S REPRESENTATIVE:

15.1 The Contractor shall keep on his work at all times during its progress, a competent foreman satisfactory to the USEPA OSC. The foreman shall not be changed, except with the consent of the USEPA OSC unless he proves to be unsatisfactory to the Contractor and ceases to be in his employ. The foreman shall represent the Contractor in his absence and all directives given to him shall be as binding as if given to the Contractor.

16. EQUIPMENT INTERRUPTING RATING:

16.1 The Contractor shall coordinate with the local power company to determine the available short circuit current. Calculations shall be made based on the available short circuit current, transformers being provided, conductor impedance, motor contribution, etc. and the equipment provided shall be sized to withstand and, where applicable, to interrupt the short circuit current that is available at the equipment in question. Ratings shall be based on testing laboratory procedures and withstandability standards. The calculations shall be submitted with reference to proposed equipment for approval by USEPA OSC before equipment is released for shipment.

SECTION 16050
BASIC MATERIALS
AND METHODS

1. GENERAL:

1.1 This Section covers basic materials such as wire, raceway, boxes, cabinets and other miscellaneous items which are basic to all systems supplied herein.

2. MATERIALS:

2.1 Conductors: The conductors meeting requirements below will be suitable for secondary power and light circuits within the limits of these Specifications.

2.1.1 All conductors shall be rated at 600 volts.

2.1.2 Insulated conductors AWG No. 8 and larger shall be stranded. Conductors smaller than AWG. No. 8 may be stranded at the Contractor's option.

2.1.3 All conductors brought to the job-site shall be new and unused and where no special factory-cut lengths are involved, shall be delivered to the job-site in standard coils.

2.1.4 No conductors smaller than AWG No. 12 shall be used except for signal or control systems, or where otherwise indicated.

2.1.5 All conductors shall be soft drawn copper conforming to the latest ASTM specifications and the requirements of the 1981 edition of the National Electrical Code (NFPA No. 70-1981).

2.1.6 Insulation: All conduits shown on the Drawings are sized for THW insulation. At the Contractor's option, THW or THWN insulation may be utilized.

2.2 Conduit:

2.2.1 No conduit smaller than 1/2-inch shall be used.

2.2.2 Rigid Conduit: Rigid conduit shall be standard weight, mild steel pipe. The conduit shall receive a protective zinc coating by means of hot-dip galvanizing. Threads shall not have any coating which will reduce the conductivity of the joint. Couplings, bends, elbows, fittings, etc., shall be subject to the same requirements as for straight lengths. All conduit and fittings shall be UL approved. Rigid conduit shall be delivered with plastic protectors on the threads.

2.2.3 Liquid tight flexible metallic conduit shall be constructed of flexible or spirally wound galvanized steel enclosed in a PVC outer jacket. Liquid tight flexible metallic conduit shall be equal to American Brass "Sealtite" Type "UA".

2.2.3.1 Connectors for flexible conduit shall be equal to Appleton type ST with grounding lugs.

2.2.4 Plastic conduit shall be schedule 40, PVC with chemical weld joints. The Contractor shall provide all fittings, adapters, etc., required for a complete installation as shown on the Drawings.

2.3 Boxes and Pull Boxes:

2.3.1 Junction boxes and pull boxes shown on the Drawings shall be as sized on the Drawings or, if not shown, according to the National Electrical Code requirements. In no case shall boxes be sized smaller than required by the National Electrical Code.

2.3.2 Construction: Junction and pull boxes shall be non-metallic, thermoplastic type where used with PVC conduit and galvanized, code-guage steel where used with rigid conduit.

2.3.2.1 Covers for junction and pull boxes with a volume of over 100 cubic inches shall be held in place by screws. Covers over 600 square inches shall be hinged on one side with hinges spaced a maximum of 18 inches and shall be held or latched in place by screws.

2.3.2.2 Junction and pull boxes in damp or wet locations shall have a gasketed cover and these boxes shall meet requirements for NEMA 4 classification.

2.3.2.3 Device boxes in damp or wet locations or containing devices denoted as weatherproof shall be non-metallic, thermoplastic with suitable water tight fittings for conduit entrance where used with PVC conduit and cast metal with threaded hubs where used with rigid conduit. Covers shall be gasketed.

2.3.2.4 Except where otherwise noted on the Drawings, device boxes in interior locations shall be the standard molded plastic boxes where PVC conduit is used and sheet steel type boxes where metal conduit is used, approximately 4 inches by 2-1/8 inches by 2-1/2 inches for one device and proportionally larger for multiple devices.

2.4 Standard Use Wiring Devices:

2.4.1 All standard use wiring devices and plates shall be of the same manufacturer. Manufacturers and catalog numbers listed below are given to establish type, quality and performance and in no way restrict the Contractor. Wiring devices by Slater, Hubbell, Bryant, or equal will be acceptable.

2.4.2 Switches: Single pole - 120-277 volt, 20 ampere, back and side wired, equal to Slater "Medalist 720-AG" series, self-grounded to device box, "specification grade", brown toggle, Catalog No. 720-AG.

2.4.3 Receptacles: NEMA 5-20R - 125 volts, 20 ampere, equal to Slater "Medalist" series with high impact resistent face, brown color, corrosion resistant live parts, back or side wired, Catalog No. 5362-AG for duplex and Catalog No. 5361-AG for single receptacles.

2.4.4 Device Plates: Device plates used over devices shall be brushed finish deluxe stainless steel (Type 302). The telephone outlet shown is mounted for the use of a wall mounted phone and no device plate is required.

2.4.5 Special Use Wiring Devices:

2.4.5.1 The receptacles shown on the Drawings as "Receptacle - Special - see specifications" shall be equal to Russellstoll Catalog No. 3743U-4, 15 ampere, 480 volts, 2-pole, 3-wire, Type FSU, cast aluminum alloy box and cover, waterproof, pin style. Receptacle unit shall be complete with adapters compatible with the type conduit used to serve the receptacle.

2.4.5.2 Provide with the receptacle described above in paragraph 2.4.5.1 a compatible plug rated the same as the receptacle and with cable clamp, watertight fitting. Install this plug on the portable transformer/disconnect/receptacle unit with type SO cable as described hereinafter.

2.4.5.3 The transformer/disconnect/receptacle unit to be mounted as shown on the Drawings in the operations building shall be equal to Square D, Class 9070, type SK, Catalog No. SK5271-W transformer disconnect unit. The transformer shall be rated 2,000 VA, 240/480 volt primary (non-fused) and 120 volt secondary (fused). A single pole, 120 volt, 20 ampere receptacle as specified hereinbefore shall be mounted in the front of this unit. A device plate as specified hereinbefore shall cover the receptacle.

2.4.5.4 The Contractor shall provide and maintain for operational use one additional unit as described in paragraph 2.4.5.3 hereinbefore except that the unit shall be fitted with a suitable carrying handle mounted on the top. Further, three (3) feet of type SO, 12/3 cable shall be installed connected to the primary of the transformer (480 V) and to the plug specified in paragraph 2.4.5.2 hereinbefore. Provide suitable, strain-relief type box connectors, terminal blocks, etc. for a complete installation.

2.5 Grounding:

2.5.1 Ground Rods: Ground rods shall be the copper clad steel type and shall be a minimum of 10 feet in length, 3/4 inch in diameter. Ground rods shall be as manufactured by Copperweld Steel Co., or equal.

2.5.2 Grounding electrode conductors shall be bare stranded tinned copper. Equipment grounding conductor shall be copper, THW insulated, green (or green with yellow tracer) in color, and rated at 600 volts.

3. EXECUTION:

3.1 Excavation, Backfilling and Grading:

3.1.1 The Contractor shall perform all earth excavation, backfilling and grading required for this part of the work. Sub-surface investigations have been made and are available for the convenience of the Contractor.

3.1.2 Depth of bury for all conduit shall be a minimum of 18 inches below finished grade, except conduit below slab which shall be a minimum of 2 inches below bottom of slab.

3.1.3 All trenches shall be of open vertical construction with sufficient width to provide free working space on both sides of the trench to allow installation of the conduit.

3.1.4 Shoring, where required, shall be installed to protect workmen and to prevent sides of the excavation from caving in.

3.1.5 The Contractor shall obtain the USEPA OSC's permission to excavate when trench depth will exceed two feet.

3.1.6 Excavated material shall be placed back from the sides of the excavation at a minimum distance of two feet.

3.1.6.1 The stockpiling of the trenched material shall be controlled in a manner which will prevent water from running into the excavation and which will not obstruct surface drainage.

3.1.6.2 The excavated material shall be used for backfilling, shall be placed in the trench in six inch layers, and shall be compacted to a density that will allow all material excavated from the trench to be returned to the trench and the original grade of the surface to be restored.

3.1.7 Trenches shall be maintained free of water until backfilling is completed.

3.2 Wire and Cable:

3.2.1 Wire shall not be installed until all work of any nature that may cause injury to the wire is completed, including placing of concrete. Further, after all process equipment is set and the heavy equipment used in setting the equipment is removed, all underground wire which has been installed shall be tested for ground and insulation resistance before energizing. Conductors failing to meet resistance tests as recommended by the manufacturer shall be replaced.

3.2.2 Mechanical means shall not be used in pulling in wires No. 8 or smaller.

3.2.3 Approved wire pulling lubricant shall be used as required to prevent insulation damage and overstressing of the wire while pulling through conduit. In no case shall conductors be greased or coated with any substance injurious to the conductor insulation or sheath.

3.2.4 Panelboard Wiring: All wiring of panelboards, motor control cabinets, etc., shall be neatly wrapped, taped, or laced into groups to provide a neat and orderly appearance in the equipment. In panelboards, wiring shall extend from the breaker lug a minimum of 2 inches; thence a series of right angle bends to its respective conduit.

3.2.5 If the size and number of conductors in a conduit on the Drawings is not shown then it shall be assumed to be 2 No. 12 wires in a 1/2-inch conduit.

3.2.6 All secondary branch circuit and feeder conductors shall be color coded to comply with Art. 210-5 of NEC.

3.2.7 Unless specified otherwise herein or shown otherwise on the Drawings all wiring shall be installed in rigid conduit or PVC.

3.2.8 Conductor Identification:

3.2.8.1 Each wire shall be labeled at both termination points. Individual conductor or circuit identification shall be carried throughout, with circuit numbers or other identification clearly stamped on terminal boards and printed on directory cards in distribution cabinets and panelboards.

3.2.8.2 In all junction boxes, cabinets, motor control compartments and terminal boxes where no terminal board is provided, each wire, including all power wires, shall be properly identified by means of a plastic-coated, self-adhesive, wire marker.

3.2.8.3 In cases similar to the above where the terminal boards are provided for the control, indicating, and metering wires, all wires including motor leads and other power wires shall be identified by wire markers as specified above.

3.2.9 Connectors and Terminal Lugs:

3.2.9.1 For the wiring of circuits consisting of AWG No. 10 or smaller wire, such as for lighting branch circuits, small power, small motors, etc., self-insulated pressure connectors equal to Scotch-Lock as manufactured by 3M Company shall be utilized for all splices or joints. BAKELITE OR HARD PLASTIC CONNECTORS WILL NOT BE ACCEPTABLE.

3.2.9.2 All stranded control wires connected to terminal boards, terminal blocks, or to other similar terminals shall terminate by means of forked spade, nylon self-insulated, tin-plated copper pressure terminals manufactured by the Thomas & Betts Company, Inc., or Panduit.

3.2.9.3 Where the wire is shown larger than that required for the load, it is done so for voltage drop or other purposes and must be installed as shown. Where the wire is stranded, the removal of strands in order to install the wire into a lug provided on any equipment will not be permitted. A larger lug shall be installed which will accept the wire size indicated where the lug can be changed and where it cannot, a tap sized to the maximum lug size shall be installed. The tap shall be not greater than one (1) foot in length.

3.2.10 Terminal Boards:

3.2.10.1 Terminal strips shall be clearly and permanently marked with ink or indelible pencil. Each wire shall be marked consistently throughout the entire system, using wherever possible the notation of the wires given on the manufacturer's wiring diagrams.

3.2.11 Direct Burial Cable:

3.2.11.1 No cable buried directly in the earth not in raceway will be allowed in this Work.

3.2.12 Grounded and Grounding Conductor:

3.2.12.1 Connections to the grounding conductor and/or the neutral (grounded) conductor shall be made in such a manner that removal of any device or equipment will not interrupt the continuity of these conductors to any device "downstream" from the device removed.

3.3 Raceway:

3.3.1 All raceway runs are shown diagrammatically to outline the general routing of the raceway. The installation shall be made to avoid interference with pipes, ducts, structural members, or other equipment. Should structural or other interferences prevent the installation of the raceways, or setting of boxes, cabinets, or other electrical equipment, as indicated on the Drawings, deviations must be approved by the USEPA OSC prior to installation, and after approval, shall be shown on the "as-built" drawings. The number of raceways shall not be less than that indicated on the Drawings. Installation of raceway beneath roadways and beneath heavy objects that are likely to settle shall be kept to an absolute minimum and shall, in each of these cases, be reinforced concrete encased.

3.3.2 Rigid steel conduit shall be used in concrete, under slabs, in hazardous locations or where shown on the Drawings. Conduit shall be kept

at least 6 inches from parallel runs of flues,steam pipes, hot gas pipes, hot water pipes or any line which is continually hot during the normal operation of the plant. Except where specifically shown on the Drawings, conduits shall have supports spaced not more than 5 feet apart and where exposed in the Operations Building, shall be installed with runs parallel or perpendicular to walls, structural members or intersections of vertical planes and ceilings, with right angle turns consisting of cast metal fittings or symmetrical bends. Conduit shall be installed so as to insure against trouble from the collection of trapped condensation. This Contractor shall plan his work so that runs of conduit miss equipment by other trades.

3.3.3 All conduit shall be run continuous between outlets with a minimum number of bends. Back-to-back 90 degree bends (180 degree change of direction) will not be acceptable.

3.3.4 During construction all new conduits shall be kept dry and free of moisture and debris. Before the wire is pulled in, all conduits shall be swabbed to clear all moisture and debris which may have unavoidably accumulated.

3.3.5 Rigid conduits, where they enter panelboards, cabinets, pull boxes or outlet boxes shall be secured in place by galvanized, double locknuts (one inside and one outside) and bushings. All bushings shall have insulating material which has been permanently fastened to the fittings. Bushings for conduit 1-1/2 inches trade size and larger shall be complete with grounding lug and shall be bonded to the box by means of bare copper wire.

3.3.6 All field bends shall be made with standard tools and bending equipment manufactured especially for this purpose. Bends in metallic conduit shall be made while "cold" and in no case shall the conduits be heated. Conduits shall not be bent through more than 90 degrees.

3.3.7 Size of conduits shall not be less than that required by the National Electrical Code and shall not be less than 1/2 inch except as otherwise shown on the Drawings. The Contractor shall install larger size conduits than detailed where the total of the angles through which the conduit has been bent during a single run exceeds 270 degrees.

3.3.8 Flexible conduit shall be installed from motor terminal boxes or other vibrating equipment to outlet or device boxes or to conduit. Lengths of flexible conduit shall not exceed 48" nor be less than 12" and they shall be installed in such a manner so as not to tend to pull away from the connectors. Connectors shall be to OZ "Ground-Tite", EFCOR grounding type, or equal.

3.3.9 Where conduits are installed in groups on a common support, each conduit shall be secured thereto by Korns, Unistrut or Kindorf clamps.

3.3.10 Raceways shall be securely and rigidly fastened in place at intervals as shown on the Drawings or as specified hereinbefore. Fastenings

shall be by wood screws or screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws, welded threaded studs, heat treated or spring steel tension clamps on steel work. Raceways shall NOT be welded to steel structures.

3.3.11 All conduit joints shall be made up tight and no running threads shall be permitted on threaded connections. Where metallic conduits are cut, the inside edge shall be reamed smooth to prevent injury to conductors. No kinked, clogged or deformed conduits shall be permitted on the job. During construction, all installed conduits shall be temporarily capped or corked.

3.3.12 Horizontal and vertical conduit runs shall be supported by one or two hole straps with clamp backs, special brackets, or other approved devices with suitable bolts, expansion shields where required, or beam clamps for mounting to building structure.

3.3.13 The use of perforated iron straps or wire for supporting conduits will not be permitted.

3.3.14 All moisture proofing or other material for thread protection shall be removed from conduit threads prior to installation. No material of an insulating quality shall be used on the conduit threads or other fittings which will reduce the overall conductivity of the conduit system.

3.3.15 Conduit which is shown as stubbed up for future use shall be installed as detailed on the Drawings.

3.3.16 Steel conduits installed in the ground shall be field-wrapped with 0.010-inch thick pipe-wrapping plastic tape applied with a 50 percent overlap, or shall have a factory-applied plastic resin, epoxy, or two coats of a field applied asphaltum tar specifically made for this purpose. Where the asphaltum tar coating method is used, the Contractor shall notify the USEPA OSC just prior to backfilling so that he may inspect the coating and approve it before the conduit is covered.

3.3.17 A non-ferrous, non-rotting drag wire or cord of a strength equaling that of a AWG #14 copper wire shall be installed full length in all open conduit.

3.4 Junction Boxes, Pull Boxes:

3.4.1 Where specifically detailed or indicated on the Drawings, boxes shall be provided, installed and supported as shown. Where not specifically shown on the Drawings the specifications hereinafter shall apply. Boxes shall be provided in the wiring or raceway systems where shown on the Drawings, wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Each box shall be sized as shown on the Drawings or shall have the volume required by the National Electrical Code for the number of conductors enclosed in the box. Boxes for mounting lighting fixtures shall be not less than 4 inches octagonal. Boxes and supports shall

be fastened to wood with wood screws or screw-type nails of equal holding strength, with bolts and metal expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or beam clamps on steel work. Penetration of more than 1-1/2 inches into reinforced-concrete beams or more than 3/4 inch into reinforced-concrete joists shall avoid cutting any main reinforcing steel. All outlet boxes, junction boxes, pull boxes, etc., shall be placed in accessible locations.

3.5 Wiring Devices, Device Plates, Etc.:

3.5.1 Unless otherwise noted on the Drawings or herein otherwise specified, the bottom of the outlet boxes for wiring devices, etc., shall be installed at the following heights above the finished surface below.

Wall Switches	4'-0"
Receptacles	1'-4"

3.6 Grounding:

3.6.1 Ground rods shall be driven vertically into the earth to at least one foot below finished grade.

3.6.2 Conductors connecting the main ground bars in switchgear to the earth shall be continuous without joints or splices. Connections to the grounding system at the switchgear shall be made with pressure connectors such as defined in Article 100, "Connector, Pressure (Solderless)", of the National Electrical Code.

3.6.3 Connections to ground rods and all other ground connections below grade shall have a MINIMUM mechanical contact surface area between the conductor and the ground rod of not less than three (3) square inches. All connections made below finished grade shall be exothermic.

3.6.4 Resistance measurements shall be made between the main grounding bar in the switchgear and a good earth ground. If this resistance is not equal to or less than 25 ohms, an additional grounding electrode system in the form of ground rods installed in a 10 foot by 10 foot grid shall be added. The rods shall be connected together and this grid connected to the system with AWG #3/0 bare tinned copper. The number of rods shall be as required to register the resistance value mentioned hereinbefore. Measurements shall be made in normally dry conditions and, in no case, less than 48 hours after rainfall.

3.6.5 Where a bare conductor is the only conductor installed in metallic conduit or other metallic raceway, and this conductor is serving as a grounding conductor, it shall be bonded to the raceway that contains it at each end of the raceway. The bond shall be made using a grounding type bushing and bonding jumper. The size of the jumper shall be the maximum size that the grounding bushing lug will accept and it shall be connected to the bushing with the lug and to the grounding conductor with a split-bolt connector.

3.6.6 All metal electrical equipment cabinets (wireways, panels, switchgear, device boxes, junction and pull boxes, lighting fixture chassis, motor control panels, etc.) shall be securely bonded to a grounding conductor running through any conduit terminating at the cabinet or enclosure by use of a grounding lug bushing and jumper wire to the enclosure wall. Switchgear, panelboards and motor control equipment shall be provided with an equipment ground bus (including lugs or screw terminals) securely bonded to the enclosure. Metal junction boxes and other enclosures (sizes 5 in. x 5 in.) shall utilize an equipment ground bus or lug as required to securely bond the equipment grounding conductor to the enclosure. The grounding conductor shall be connected with pressure connectors at the main switchgear to the main grounding system. Where screw terminals or set-screw lugs are used, sufficient lugs shall be provided such that not more than one conductor is installed into each lug or terminal.

3.6.7 All circuits shall contain a grounding conductor rated as required by Article 250 of the National Electrical Code or as shown on the Drawings. This grounding conductor shall be connected to the main grounding conductor in the switchgear from which the circuit emanates. Individual components of the system served by the main feeder circuit shall have their enclosures connected to the main feeder grounding conductor with pressure connectors.

3.6.8 Where motors are served by circuitry utilizing a separate grounding conductor and where the actual connection of the conduit to the motor entrance compartment is made using flexible conduit, the grounding conductor shall be connected inside the entrance compartment to the motor frame with a bolted solderless pressure connector. Bolts, nuts, washers and other assorted hardware shall be bronze, cadmium plated steel, or other corrosion resistant material. The motor ground connection shall be to the motor frame and independent of the mounting bolts or sliding base.

3.6.9 The neutral point of all transformer secondary windings of the system shall be connected to the grounding system. Transformer enclosures shall be grounded.

3.6.10 Lightning arresters shall have a suitable, separate, grounding conductor connecting the lightning arrester with a separate ground rod. This rod shall be interconnected with any adjacent grounding system.

Specification Section No. 16050

SECTION 16050
BASIC MATERIALS
AND METHODS

In accordance with the requirements of the General Conditions and Supplementary General Conditions, the following information is required of the Contractor.

ITEM OR DESCRIPTION	SHOP DRAWINGS	CATALOG DATA	PARTS LIST	OPERATING MANUAL	WIRING DIAGRAM	CERTIFICATION	SAMPLES	OTHER
Conductors		X						
Conduit		X						
Boxes & Pull Boxes		X						
Wiring Devices, Standard		X						
Wiring Devices, Special Use	X	X	X		X			
Ground Rods		X						
Ground Conductors		X						